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Advancing under fire wartime change and the U.S. military

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THESIS

ADVANCING UNDER FIRE: WARTIME CHANGE AND THE U.S. MILITARY

by

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December 2008

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ADVANCING UNDER FIRE: WARTIME CHANGE AND THE U.S. MILITARY

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This study begins with the premise that no military is ever optimally configured for any conflict into which it enters. Therefore, the need for significant changes to doctrine, organization, and technology almost invariably arises. Significant changes do not come about easily in military organizations, especially during wartime. This study examines the underlying conditions necessary for making major changes during wartime. It first surveys the relevant literature covering both military and organizational change in order to build hypotheses about wartime change. It then develops a framework and typology with which to study change in the complex endeavor of a military at war. Finally, it uses the United States military's experiences in World War II, Vietnam, and the Global War on Terror as case studies with which to test those hypotheses and derive conclusions about the conditions under which change can occur during wartime.

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I. INTRODUCTION

A. RELEVANCE

The complexity of warfare is such that it is exceedingly difficult to adequately prepare a military force for every eventuality it might encounter once engaged with an enemy. Nevertheless, pre-war training can help improve the odds of success relative to a less prepared foe. A military's capability to accurately assess changing conditions and adapt itself accordingly while engaged in combat may not prove to be *the* decisive factor in victory, but history shows that it helps. Perhaps more importantly, the ability to understand the need for and implement required changes is essential to turning around a losing effort and avoiding defeat.

B. PURPOSE

The purpose of this study is ultimately to advance our understanding of the changes militaries undertake during wartime. By examining successfully implemented changes to critical elements of doctrine, strategy, technology, and tactics within their applicable contexts, one can isolate key events or patterns that reveal the change mechanism at work. It is through understanding the forces that enabled change—and perhaps those forces that prevented it when it was necessary—that one gains a greater understanding of how to reconfigure a fielded military, when reconfiguration is required, and how to increase the chances that reconfiguration will achieve its desire effects.

C. CONCEPTUAL FRAMEWORK

1. Change

Change, in the broadest sense, is simply the act of making something different. To accurately explain the forces and conditions that enable change, one must first necessarily define what is meant by "military change." This definition must include the implicit assumption that for a military to initiate change during wartime, it does so with the purpose of improvement. Additionally, change occurs at all levels of conflict, but an attempt to identify and study every single recorded change taking place during a given

conflict would result in little useful information. The intent here is to understand the dynamics of change at all levels of war, and how one can affect the others.

At the other end of the change spectrum, limiting the scope to grand-scale or "revolutionary" changes eliminates many instances of change worthy of study. In order to better define the types of changes that are of interest, this study imposes a threshold above which a change becomes “significant.” To that end, this study uses the following working definition of "significant" military change:

> *Altering doctrine, tactics, technology, or organizational structure with the intent of better achieving a military's objectives.*

It is the *intent* of the organization to improve its outcomes that is important in this definition. Change is initiated toward a specific purpose. Equally important is the implication of change taken on behalf of an organization or military unit. Though the idea or stimulus for the change may originate outside the organization, the organization itself must implement the change as a collective.

2. Wartime

What defines “wartime”? What constitutes “war” and when does it officially begin? Drawing these distinctions becomes particularly problematic when both “conventional” and “irregular” conflicts are compared, as they are in this study. Therefore, a the working definition of “wartime” includes the period of time between when the U.S. prepares to engage in combat against an enemy force and the point at which the conflict ends in decisive victory or withdrawal of American forces. The preparatory phase is important because it sets the baseline configuration with which the military will enter its first engagements against an enemy. The assumptions made during the preparatory phase necessarily affect the subsequent ease or difficulty to make subsequent changes. The emphasis of this study is then on the mechanisms by which change is carried out by a force whose attention is heavily occupied by enemy fire.

3. The Levels of Warfare

Warfare, like a corporate enterprise, is managed at different conceptual levels by different parts of the organization. Much as a CEO does not generally interface with

customers as part of his daily routine, the commander-in-chief never takes up arms against the enemy. Each relies on a hierarchical organization to achieve an endstate vision. Therefore, to establish a framework for this analysis, it is necessary to define the individual "levels" at which warfare is both managed and executed. The current joint doctrinal definitions are used here to distinguish each level of warfare.

The strategic level of war is

> the level of war at which a nation, often as a member of a group of nations, determines national or multinational (alliance or coalition) strategic security objectives and guidance, and develops and uses national resources to achieve these objectives. Activities at this level establish national and multinational military objectives; sequence initiatives; define limits and assess risks for the use of military and other instruments of national power; develop global plans or theater war plans to achieve those objectives; and provide military forces and other capabilities in accordance with strategic plans. (Joint Publication 1-02, 2008)

The operational level of war is

> the level of war at which campaigns and major operations are planned, conducted, and sustained to achieve strategic objectives within theaters or other operational areas. Activities at this level link tactics and strategy by establishing operational objectives needed to achieve the strategic objectives, sequencing events to achieve the operational objectives, initiating actions, and applying resources to bring about and sustain these events. (Joint Publication 1-02, 2008)

And the tactical level of war is

> the level of war at which battles and engagements are planned and executed to achieve military objectives assigned to tactical units or task forces. Activities at this level focus on the ordered arrangement and maneuver of combat elements in relation to each other and to the enemy to achieve combat objectives. (Joint Publication 1-02, 2008)

While these definitions provide some clarity, the nature of warfare is such that rarely do changes implemented at one level yield effects solely at that same level. A change in overall war strategy will necessarily drive changes to campaign objectives and means—the operational level—and perhaps also influence how exactly the ensuing battles are fought—the tactical level. The doctrine cautions: "There are no finite limits or boundaries between them" (Joint Publication 1-02, 2008).

Furthermore, changes implemented at one level are often preceded by discussions and decisions at levels above. What is critical to the discussion of the "levels" of warfare is the concept of *management*. Wars are indeed *fought* by military forces—those who engage the enemy somewhere in the battlespace—but are *managed* according each distinct level. There are no neat lines dividing the levels of war. Neither then, should one expect to see neat lines defining the boundaries between the level at which each change was implemented.

Mintzberg and Westley (1992) argue that "Change in organizations occurs between levels as well as within levels. Conceptual clarity concerning the level where the change originates or is focused is essential if the process of change as well as its comprehensiveness and the triggers that evoke it are to be understood." Therefore, each sample change presented in this study is assigned to a particular level—the one at which it was *initiated*, or put into action. The reason for this method of assignment is that ultimately, change is the sum of both an idea and its implementation. For an idea to persist through implementation, it will likely weather debate about its merit and attempts to defeat it. The level at which this debate occurs is where the factors that influence should be present.

An example that will be used later is that of the battles fought among the hedgerows by the allies following the Normandy invasion in 1944. Changes made at the tactical level, in the form of equipment modifications, communications procedures, and combined-arms tactics all synthesized to enable the achievement of critical campaign objectives and ultimately influenced strategy (Doubler, 1994). Failure to make the incremental tactical changes would have kept the allies bogged down in Normandy, and would have forced a significant change in strategy as the allies came to the realization they could not push through German lines through France and on into Germany.

As the term "doctrine" at times varies between authors, it is also necessary to "fix" a definition here. In the current joint publication literature, doctrine is defined as "Fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives" (Joint Publication 3-0, 2008). Doctrine, therefore, does not confine itself to a single level of warfare; in a broad sense it could be

considered to encompass the other two modes of warfare examined in this study: organization and technology. But for the purpose of this analysis, such an aggregation obfuscates the underlying factors that drive changes. Doctrine, then, is the set of *fundamental principles* on which an organization or service relies to achieve its given mission or stated objective. It is independent of level, but may impact all three.

This study makes use of the two broad categories of external and internal conditions affecting military change. Pierce (2004) contends that understanding the external factors—the *why* and the *when* surrounding military innovation—is important, but the internal mechanisms by which such innovations are managed—the *how*—to achieve full potential are equally important.

Commanders who implement change while engaged with an enemy incur significant amounts of real and/or perceived risk. This line of thinking generally correlates to an "organizational" perspective of change—that organizations internally process their strengths and weaknesses, identify both opportunities and threats, and make choices accordingly to achieve their objective. In theory, the better an organization is structured and led toward this end, the more successful it will be in achieving its desired goals.

The corollary is the external perspective. With respect to military organizations, interactions with the enemy and the environment fall into the "external" category. The distinction between "internal" and "external" factors can be blurred, particularly if one takes the strict organizational theory perspective that how an organization responds to a highly uncertain environment—such as combat—is largely a result of its internal structure, leadership, etc. In that sense, most all changes would be the product of internal actions. However, as this study seeks to understand the underlying conditions—the influences—rather than the mechanics necessary for change, the distinction between internal and external is still useful to distinguish between those factors the organization can control (internal) and those that it cannot (external).

4. Typology

To better understand the changes militaries make during conflict, they must first be classified. At the most basic level, Farrell and Terriff (2002) provide useful descriptions for the nature of how a change was initiated. They define three "pathways" to military change: (1) *innovation* is the development of new military technologies, tactics, strategies, and structures where none previously existed; (2) *adaptation* is adjusting existing military means and methods, simply changing what already exists; (3) *emulation* is the importing of new tools and ways of war through imitation of other military organizations, to include directly copying. This study adds a fourth "pathway" of change: *abandonment*. Abandonment is the act of dissolving an existing organization or eliminating an employment concept. These four types of change aid in classifying and understanding the changes observed throughout this study.

D. EXISTING THEORY

Presented here are synopses of the most relevant theories regarding change and innovation, within both military and where applicable, organizational behavior literature. This body of theory will form the basis for the hypotheses used in this analysis.

The preponderance of military change studies assign a level of significance to the change proportional to the magnitude of its respective outcome. For example, Farrell and Terriff (2002) focus exclusively on "major" changes, characterized by the development of new organizational goals, strategies, and structures.

Posen (1984) draws his conclusions about the formation of military doctrines — or "how battles are fought" — by using organizational behavior and balance of power theories. He argues that during interwar periods, civilian intervention stems from either perceived opportunities or threats, and is required to overcome a military's tendency towards stagnation. He also concludes that the balance of power theory is the more powerful instrument for explaining military change.

Dupuy (1980) defines the necessary process militaries undertake in order to successfully implement anything new. Though his work focuses primarily on technology, its framework is broad enough that it may be applied to doctrine, organization, and

tactics. “Anything new” must follow a path consisting of three phases, each of which must be complete before that military achieves the full potential advantage offered by the new weapon or system: (1) invention, (2) adoption, and (3) assimilation.

He also argues that historically, the numbers of inventions have increased exponentially and that the interval between invention and adoption has decreased significantly, but that the interval between adoption and assimilation — the interval of "effective use" — has not changed appreciably: approximately twenty years when the necessary conditions for assimilation have been present. When they have not been present, it has taken longer. His theory holds many implications for a military attempting to innovate or make major changes during wartime.

According to Dupuy, wartime militaries must still pass anything new through these phases to achieve the desired results. To the extent it can complete this cycle, it can generate change. Dupuy’s argument implies that in order to succeed at changing something during the course of a conflict, there must exist a system to enable the completion of all three phases rapidly, achieving “assimilation” in sufficient time to reap the benefits of the new “thing.”

Davis (1967) argues that a “zealot” must exist to champion an innovative idea, and though neither zealots nor ideas succeed on their own, there can be no progress without at least one of them. He also argues that the majority of proposed changes are for means to better accomplish existing tasks and not for revolutionary capabilities. Perhaps more importantly, he describes a common pattern of “counter-innovation.” In this pattern, a resistance movement forms at higher ranks, then expands downward to the lower ranks. Ultimately, the claim of excessive cost is used to attempt to kill the innovation, primarily because its enemies do not wish to be perceived as “non-innovative.”

Avant (1994) argues that a specific organization’s structure, biases and culture must include leadership incentives — rewards or promotion — for innovation to occur. Mendeles (1998), building on the work of Cohen, March, and Olsen (1972) puts forth the "Garbage Can Theory" of organizational behavior, that the proper alignment of effort,

time, attention, resources, expense, and good luck must align concurrently to enable technological innovations. While perhaps an accurate descriptor, the theory is of little practical explanatory use.

Pierce (2004) builds on those theories of Posen, Rosen, Cote, and Kier, to develop the concept of "disruptive change" to military innovation, which is defined as "an improved performance along a warfighting trajectory that had not previously been valued." He contends that disruptive innovations have historically had to be disguised initially as "sustaining" innovations (those that improved capability along an existing warfighting trajectory) to ensure their survival.

Rosen (1991) defines military innovation as "a change in one of the primary combat arms of a service in the way it fights or alternatively, as the creation of a new combat arm." He further frames the difficulties of military innovation as closely related to the fundamental characteristics of bureaucracies. He explains that large bureaucracies are not only "…hard to change, but…are designed not to change." When military bureaucracies do manage to change, there is no universal explanation as to why or how. He argues that wartime innovations result from either the pursuit of inappropriate strategic goals or the misunderstanding of ongoing military operations and the goals they are supposed to achieve. Finally, he asserts that a military can innovate if organizational learning can take place "under the unique conditions of war," as long as the organizational learning leads to a rethinking of the fundamental assumptions about how operations lead to victory.

Unfortunately, he fails to elaborate about what "organizational learning" means to a combat organization during wartime. He does, however, acknowledge the problematic nature of defining organizational learning. Perhaps more importantly, he also observes that simply thinking about or dreaming up a better way to wage war is insufficient. Implementation is the other critical—and oftentimes, more difficult—component. Rosen's work therefore suggests that in order to understand the conditions that enable military change, one must account for two critical components: (1) the development of the new idea or concept, and (2) the implementation process.

There are many competing theories about how organizations learn, what distinguishes “organizational learning” from a “learning organization,” and ultimately how useful the concepts and language are to improving organizational performance. Further theories center around whether it is composed of structural and cultural components (Lipshitz and Popper, 1998), or is the result of a delicate balance between the organization's efforts at exploitation and exploration (March, 1991). The development of diverse definitions and conceptual variance led to the description of the “mystification” of organizational learning (Friedman, Lipshitz, and Popper, 2005) and the observation that “The more organizational learning is discussed, the less clarity and agreement there seems to be about its very definition” (Berthoin-Antal, Dierkes, Child, & Nonaka, 2001, in Friedman, Lipshitz, and Popper, 2005).

Indeed, so much definitional variation begs for an “integrated model,” which Örtenblad (2004) develops for the “learning organization.” He contends there are only four qualities required for an organization to be a “learning organization”: (1) learning at work; (2) organizational learning; (3) developing a learning climate; and (4) creating learning structures—all of which must be present. And none of which help better define the concept. His use of the term “organizational learning” as a quality of a “learning organization” is indicative of the many obfuscations present within the realm of organizational learning theory. In Örtenblad's (2004) “integrated model,” the term “organizational learning” specifically refers to the organization's characteristics of “being aware of the need for different levels of learning…the storing of knowledge in the organization…” and that it be “…actually used in practice.” Though it is more specific and simplified, it is not clear that Rosen is referring to this type of definition.

The most relevant definition of organizational learning for the purpose of this study is that developed by Argyris and Shön (1978). They divide learning into two distinct categories: single-loop learning and double-loop learning. Both individuals and organizations can experience each type. Single-loop learning refers to error correction, or taking measures to return to a previous state. The classic example is that of a thermostat, which can take measures to return the temperature of a room back to that set by the user because it is configured to measure the temperature in the room—to receive feedback on

the state it is supposed to regulate. In an organizational context, error detection and correction that enables the organization to achieve its current objectives is single-loop learning.

Double-loop learning occurs when error is detected and corrected in ways that involve the modification of an organization's underlying norms, policies and objectives. It can only be achieved in an organizational setting when individuals are not only able to identify errors and corrections, but also able to synthesize a view of the problem area that enables them to develop a solution that alters the fundamental elements that led to the problem in the first place (Argyris & Shön, 1978).

For example, the German reformulation of their fundamental way of warfare following the stagnant, bloody experience of World War I can be considered double-loop learning. Instead of making marginal improvements to their existing means — namely the static defense and individually-functioning combat arms — they endeavored to understand the fundamental nature of the problem and devised a solution — the combination of coordinated mass and speed known as *Blitzkrieg.*

Innovations, therefore, should be the product of a military organization that had in place the personnel, structure and culture in which fundamental propositions about strategic objectives could be not only challenged, but overturned in favor of alternative ones—an organization in which double-loop learning could occur. Single-loop learning, on the other hand, should produce incremental changes along existing strategies and methods. However, as Rosen (1991) observes, simply thinking about new and improved methods of warfare is not sufficient by itself. In the end, militaries are organizations, even when at war. Combat organizations are subject to many of the same dynamics and challenges as other bureaucracies. Indeed, combat units have more incentive to resist change than do other types of organizations. As Air Vice Marshal R. A. Mason (1986) observes:

> In organized Western armed services, conformity, reliability, and teamwork have long been essential ingredients of esprit and confidence within the unit. Mutual dependence normally requires coordinated, predictable behavior from colleagues, whether in an infantry platoon or in a four-ship formation. The demands of teamwork tend to inhibit

> independent action. Above the level of the fighting unit, further restrictions apply…when one reflects on all the factors militating against innovation in modern military affairs, it is astonishing that tactical and technical innovations ever take place at all.

Therefore, some of the theory governing how organizations implement and manage change applies. The difficult questions are (1) which theories? and (2) how does one distinguish between applicable and non-applicable theory? The unique environment, temporal dimension, and "interaction" with competing organizations (i.e. the enemy) require a careful selection of theory governing organizations that function in highly complex environments under conditions of uncertainty.

Fundamental to any organization's ability to change is its ability to identify the need to do so. Weick and Sutcliffe (2001) argue that an organization, in order to be capable of adapting to rapid, potentially catastrophic events must strive for a state of *mindfulness*, which is defined as "…hav[ing] a rich awareness of discriminatory detail and an enhanced ability to discover and correct errors that could escalate into a crisis." *Mindfulness* results from possessing five specific traits: (1) preoccupation with failures rather than successes, (2) reluctance to simplify interpretations, (3) sensitivity to operations, (4) commitment to resilience, and (5) deference to expertise, as exhibited by encouragement of a fluid decision-making system (Weick & Sutcliffe, 2001).

However, another argument advanced by Downs and Mohr (1976) suggests that there is no unifying theory of innovation, and that the study of innovation is characterized by the existence of distinct types of innovations whose adoption can best be explained by a number of correspondingly distinct theories. These theories may include different variables, or they may contain the same explanatory variables while positing different interrelationships among them and different effects upon the dependent variable.

If it is not possible to develop unified theories of change, then what can one hope to have at the end of this study? The Minnesota Innovation Research Project provides perhaps the most comprehensive study of organizational innovation to date. The authors conclude that any good theory of innovation must be able to do four things: (1) explain how structure and individual purposive action are linked at local and global levels of

analysis, (2) explain how innovation and change is produced both by the internal functioning of the structure and by the external purposive actions of individuals, (3) explain both stability and instability, and (4) include time as the key historical metric—a change is a difference that can be noted only over time in an entity. Furthermore, the authors conclude:

> Based on the findings from the MIRP studies, we contend that a single theory cannot encompass the complexity and diversity of innovation processes. Instead, several different theories or models may explain innovation processes, and which theory holds depends on the context and conditions confronting a given innovation. This preliminary conclusion leads us to address the need for a metatheory of innovation process. (Van de Ven, Angle, & Poole, 2000)

To that end, a metatheory—an overarching combination of theories—will result in the most comprehensive explanation of the underlying conditions that enable militaries to effect change, both during peacetime and combat.

E. METHODOLOGY

This study makes use of a single case—the U.S. military—over time. Specifically, eight explanatory hypotheses are tested through the qualitative analysis of 64 significant wartime changes undertaken over the course of three conflicts: World War II, Vietnam, and Operation Enduring / Iraqi Freedom. Each conflict is first surveyed to identify and classify significant changes that occurred. It is not the intent of this study to capture every single major change across each branch of service and to joint warfighting—that would far exceed the scope of this analysis. Instead, this study makes heavy use of the historical literature to identify those significant changes that have come to be somewhat emblematic of their respective conflicts, and samples them accordingly. The primary research question of this study is:

> *What are the underlying conditions necessary to effect significant change during wartime?*

To that end, this study seeks to uncover the stimuli, process, and context associated with each sample of wartime change. It draws on the empirical historical data and narratives of each conflict. In those instances where the means by which change was

achieved is sufficiently and unambiguously documented, the data is used. If no data exists, or there are conflicting accounts of how the change occurred, it was discarded and does not appear.

In analyzing each instance of change, this study employs a simplification of the model of the change process developed by Lewin (1948) to understand what conditions enabled the change to occur and proceed through to implementation. Lewin described change in an individual or group beginning with an "unfreezing" of the existing situation, followed by the act of implementing the new condition, then a "freezing" of the organization in the new condition.

1. Conflict Selection

The conflicts were selected because each possesses four primary attributes: (1) they are sufficiently lengthy that long-term changes were undertaken during the conflict, (2) they are sufficient in length to evaluate the entire cycle of the changes, (3) they are of a magnitude sufficient to command significant national resources, and (4) there is enough unclassified material published about them to select sample changes and study them in the detail required for this analysis.

Furthermore, each conflict has its own unique context that adds to the discussion and understanding of military change. World War II saw a somewhat reluctant United States pulled into two separate theaters of war, ultimately fully mobilizing its national resources. The sheer numbers of U.S. forces involved, the crystallization of national will, and burgeoning technology combined to create a massive force that developed its technology and doctrine as it fought its way across two geographically separate theaters.

The Vietnam War, on the other hand, presents an entirely different backdrop for military change. American involvement began in an extremely limited role—primarily that of an advisory capacity. A focused counterinsurgency effort followed, which was eventually scrapped for a full-scale conventional war involving hundreds of thousands of American troops. Each phase of this war is unique, as are the factors and decisions that were made along the way—particularly in the greater context of tactical victories leading to strategic defeat.

Operations Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) present the challenge of analyzing changes without having a definitive outcome against which to weigh them. Specifically, this study makes use only of operations in Afghanistan and Iraq. It does not address OEF operations in the Philippines, the Trans-Sahel, or the Horn of Africa, largely due to the author's desire to keep the study unclassified and focused on those operations in which the preponderance of effort is military. Additionally, OEF-Afghanistan (referred to as "OEF" for simplicity) and OIF are two distinctly different conflicts but for the purpose of this study are treated as essentially a single warfighting effort. This is because one conflict effectively served as preparation for the other and the same regional combatant commander (RCC) and staff lead them; indeed they have been waged simultaneously for all but the first 17 months of OEF.

F. HYPOTHESES

Hypotheses regarding the conditions underlying wartime change fall into two broad categories: internal and external. As change is seen as a product of decision or action by the military at a specific "level" of warfare the following hypotheses are level-specific. The exception is the implementation of technological change. It does not fit neatly into one of the three categories and is separate. Technological change is a function of the military-industrial complex and a fielded military force's ability to harness it, which effectively spans all three levels of warfare. Therefore, it has its own set of governing hypotheses.

1. Internal

At the strategic level, changes require a *product champion*: a proponent who understands the need or opportunity, and either has the authority to implement the new idea or is able to influence those who do.

At the operational level, changes are *planned and managed* by the warfighting command to achieve the strategic objectives laid out by the national leadership.

At the tactical level, significant changes result when the command relationship between the operational and tactical commanders is *decentralized* in nature.

Technological change is the result of *procurement inertia*—where pre-existing systems will be "sped" to the field to remedy deficiencies for which they may or may not have been designed.

2. External

At the strategic level, *civilian intervention* is required to implement significant changes.

At the operational level, changes in capability *emerge* as a result of interactions with an enemy and the subsequent adjustments.

Changes at the tactical level result after a unit experiences *unexpected* mission failure or higher than anticipated numbers of casualties.

Changes to technology and technical systems occur because of a *combat need*: an existing deficiency or anticipated future requirement of the combat environment.

	Internal	External
Strategic	*Product Champion*	*Civilian Intervention*
Operational	*Planned*	*Emergent*
Tactical	*Decentralized Command*	*Unexpected Mission Failure or High Casualties*
Technological	*Procurement Inertia*	*Combat Need*

Table 1. Explanatory Hypotheses Summary

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II. WORLD WAR II

A. INTRODUCTION

World War II provides a rich case from which to draw samples of significant changes undertaken during wartime. The history of World War II is well documented and numerous major changes are found within. One difficulty encountered during the examination of World War II (and indeed, during the next two conflicts) was to draw a line marking the start of U.S. involvement in the war. American policymakers began to view war with Germany inevitable in 1940, and started preparing according to what their predictions about that war would entail. Another difficulty is to assign significant changes specifically to the American military effort; many changes resulted from combined U.S.-British discussions and planning. In those cases where it is clear which country spawned the idea or led the initial effort, the appropriate country is credited.

B. BACKGROUND

During the late 1930s, much of Europe watched as an ascendant Adolph Hitler disregarded the limitations placed upon Germany by the Versailles treaty. Numerous nations prepared for war. Following the 1939 invasion of Poland, the United States remained isolationist, committing only matériel and moral support. As the remainder of Western Europe fell and Nazis peered across the English Channel, the U.S. remained committed only to the defense of Great Britain. Though many viewed entry into the widening war inevitable, it took the shock of the attacks at Pearl Harbor for the U.S. to commit to fighting the Axis powers militarily.

Though the U.S. did not officially declare war until after the Japanese attack on Pearl Harbor, it did view the German aggression in Europe as an indicator of looming conflict. Additionally, German U-boats were interdicting American merchant ships well before the U.S. officially entered the war. Pre-war preparations began more or less in 1940, and were based on the assumptions about what such a war—to be fought primarily in Europe—would involve. In this case, the changes the U.S. made in preparation for

conflict were based largely on its understanding of the enemy's military actions, and are considered "wartime," even though several occurred before America's formal declaration of war.

What distinguishes World War II from the other conflicts in this study is the totality with which the United States committed resources to the military effort. This has significant impact on the number of changes that take place over the four years of direct U.S. involvement. New equipment was designed and fielded almost continuously. Doctrine was tested repeatedly against enemies in multiple theaters. Organizations were formed and re-formed. If an idea could be formulated well enough to be proposed, it was likely that someone would investigate its feasibility.

Finally, the nature of warfare waged during World War II embodied what we now consider "conventional" warfare—massed, mechanized forces competing to occupy each other's territory and crush each others' matériel capabilities. This is not to say that there was no use of "unconventional" or innovative means during World War II—there were many. Some, such as the operations carried out by the OSS's Jedburgh teams have become legendary and heavily influenced modern "irregular" warfare thought. However, the preponderance of significant changes made during World War II involved adapting and integrating scientific advancement for military purposes.

C. SAMPLE CHANGES

The following instances of change are presented and analyzed not because they were the most significant, or yielded the greatest effects (though clearly some did, such as the atomic bomb). These changes were selected based on their unique position in reference to the mode (doctrinal, organizational, or technological) and domain (sea power, airpower, land power, or some combination thereof) classifications presented in Table 2.

	Sea	Land-Sea	Land	Air-Land	Air	Sea-Air
Organizational	ASWORG (Anti-sub Warfare Ops Research Group)	Marine Raiders	OSS OSRD (Office of Scientific Research and Development)	Airborne Divisions	Air Commandos	
Doctrinal	Anti-Submarine Warfare	Amphibious Operations Doctrine	Mounted Cavalry Armor	Close Air Support Airborne Doctrine	Daylight Precision Bombing Airpower Roles Nighttime, Low-Level Incendiary Bombing	Carrier Doctrine
Technological	SONAR 10cm RADAR HF/DF Systems	Specialized Landing Craft	Bazooka "Hedgerow Combat"	Glider / Parachute	Unmanned Bombers Norden Bombsight Long-Range Escort Fighters	

Table 2. Selected Changes for World War II

The 26 changes presented are interrelated. In many instances, technological changes feed into larger doctrinal changes, as is the case with ASW doctrine.

1. Anti-Submarine Warfare (ASW)

Changes to the U.S.'s approach to ASW span all levels and modes. However, the ASW doctrine in place when the U.S. began suffering its first merchant shipping losses in 1942 can only be characterized as being the result of shortsightedness on the part of the U.S. Navy. This was not the first time the U.S. had experienced the interdiction of

merchant vessels at the hands of German U-boat submarines. The latter days of World War I were marked by the very same problem (Polmar & Allen, 1991). Regardless, the U.S. Navy's solution was to seek out the U-boats and destroy them (Owen, 2007). The Chief of Naval Operations and Commander-in-Chief, U.S. Fleet at the time, Admiral Ernest J. King, insisted the U-boat threat be countered by traditional ASW forces and methods. He initially refused to institute mandatory convoys for merchant ships crossing the Atlantic (Shachtman, 2002) in spite of the fact that the British had previously successfully reduced their losses by instituting convoys and escort tactics—and shared their results with the U.S. Navy (Polmar & Allen, 1991).

It is important to note that the ASW effort in the Atlantic directly competed for naval resources needed for the upcoming Pacific campaign. It was not until the spring of 1942, amidst shipping losses approaching 100 vessels and over 500,000 gross tons *per month* that Admiral King became receptive to a suggestion for changes to Atlantic ASW strategy. At the suggestion of one of his staff officers, Captain Wilder D. Baker (U.S. Navy), King agreed to the establishment of a group to analyze the U-boat problem and make recommendations for improvement. As a result, the Anti-Submarine Operations Research Working Group (ASWORG)—loosely modeled after the British Operations Research (OR) organization—was formed within the National Defense Research Committee (Shachtman, 2002).

The ASWORG completed an in-depth study of the U-boat problem with a focus on tactics, sensors, and weapons, and ultimately made numerous technological and tactical recommendations. Unfortunately, Admiral King was slow to order the adoption of new technology to the ASW problem, instead implementing only those technical improvements that contributed to the established "sub hunting" doctrine. In March of 1943, after over a year of "uncontrollable" losses of allied shipping and extremely poor results from sub hunting, the Chairman of the National Defense Research Committee, Dr. Vannevar Bush, personally lobbied President Roosevelt to order King to implement the remainder of improvements identified by the ASWORG; King agreed to make the changes (Shachtman, 2002).

Over the course of the next four months, the implementation of three key recommendations began to stem the hemorrhaging of matériel caused by the U-boat fleet. Improved patrol search tactics, high-frequency direction-finding (HF/DF) equipment and improved S-band (microwave) RADAR and improved anti-submarine weapons/munitions all combined with the breaking of the German radio traffic encryption to boost sharply Allied U-boat kills (Sternhell & Thorndike, 1946; Shachtman, 2002).

Eventually, allied ASW efforts expanded to include the use of convoys, escorts (both aircraft and surface vessels), improved RADAR (aboard both ships and aircraft), medium bombers, and perhaps most importantly, the U.S. Navy's Tenth Fleet—the "paper fleet" comprised of approximately 100 former ASWORG analysts and scientists. Tenth Fleet's mission was to apply operations research and recommend further improvements. Furthermore, the breaking of the Enigma code by allied cryptanalysts also contributed to the ability to anticipate U-boat movements. By war's end, German U-boat capability was sharply diminished by all of these improvements, plus the shift in doctrinal thinking from sub-hunting to "prevent[ing] enemy submarines from accomplishing *their* aim." (Sternhell & Thorndike, 1946)

2. SONAR

One of the contributing factors to American unpreparedness for countering German U-boats was the pre-war belief that recent advances in SONAR and depth charges would keep the U-boat threat in check. The U.S.'s SONAR capability was actually provided by the British (whose system was called "Asdic"), and by late 1939 all American destroyers were equipped with a set (Polmar & Allen, 1991). Unfortunately, due largely to its extremely classified nature, SONAR was not adequately tested prior to the outbreak of war (Till, 1996). As a result, it was far less effective at detecting submerged U-boats than widely expected. Not only did the equipment have limitations, but the U-boat commanders quickly adapted their hunting tactics to attack from the surface, which prevented them from being acquired by SONAR. Additionally, the U-boat fleet was soon modified with acoustic sensors, which allowed U-boat crews to hear the

"ping" produced by the SONAR sets, and therefore gave the U-boat advance warning of an allied vessel searching. These two German developments negated the already limited capability of SONAR (Polmar & Allen, 1991).

In an attempt to improve SONAR's U-boat detection capability, both the British and U.S. navies made incremental improvements to their existing SONAR sets. In 1944, the British fielded an add-on transmitter/receiver with a shallower "look-down" angle, known as the "Q" attachment. The U.S.'s efforts at improving SONAR resulted in minor upgrades to the electronic circuitry. Neither effort made a significant improvement to the performance of SONAR against the U-boat (Gerken, 1986). SONAR played a minimal role throughout the remainder of the conflict, largely due to the other, more effective technical and technological advances made in the field of RADAR and HF/DF detection.

3. RADAR

Once the U-boat fleet negated the advantage provided by SONAR, British forces began experimenting with ship-board and aircraft radars to search for surfaced U-boats. Their initial trials were largely unsuccessful due to the existing wavelengths being sub-optimal for resolving surfaced submarine-sized targets. By the end of 1941, British scientists developed 10 centimeter wavelength (S-band) RADAR sets and began installation on fleet vessels. The British shared their advances with the U.S. Navy and by 1943, S-band RADAR sets were widely in use aboard ships in both fleets (Sternhell & Thorndike, 1946).

The primary effect this development had on the U-boat fleet was to deprive it of its ability to surface undetected at night, and therefore significantly hindered its attacks on merchant convoys. With their ability to attack from the surface all but eliminated, the Germans began developing a both a more advanced submarine (the Type XXI) that could carry out its entire mission without surfacing and a snorkel-like device that permitted existing U-boats to remain submerged but still be able to charge their batteries (Polmar & Allen, 1991). As it turned out, an advanced submarine was not necessary for the Germans to negate the Allied improvement, as the S-band RADAR was also used as a night targeting aid aboard on several models of aircraft—one of which crashed in German

territory in March of 1943. Seven months later, the Germans fielded a receiver capable of receiving the S-band, which provided the U-boat crews advance warning of approaching Allied ASW ships and aircraft. Soon thereafter, Allied developmental work began on yet another RADAR frequency band (X-band) in an attempt to regain the advantage (Gerken, 1986).

4. High-Frequency Direction-Finding (HF/DF) Systems ("Huff Duff")

Another technology adapted for military use by nearly all of the major powers of the time is radio direction-finding (DF) equipment. In the late 1930's, the British successfully developed a system that could "DF" in the high frequency (HF) range—providing a directional line-of-bearing to the radio source. U-boat crews transmitted at these frequencies because of they believed that it was not possible to "DF" an HF-band frequency (because their own scientists had been unable to accomplish it—a belief they held long after Allied ASW measure became noticeably more effective to U-boat crews). HF/DF systems were initially fielded in British coastal watch stations, but their effectiveness from land was limited. By 1940, shipboard sets were fielded, and by 1943, at least two escort ships in every Atlantic convoy were equipped with a set (Owen, 2007).

Employing multiple shipboard HF/DF systems within a single convoy generated multiple lines-of-bearing to a U-boat radio transmission, which meant escorts could effectively triangulate a U-boat's position and either steer the convoy clear or coordinate with an attack asset. The mere presence of an attacker caused the U-boat to submerge, negating its ability to attack (Polmar & Allen, 1991). HF/DF systems continued to be effective against U-boat crew throughout the Battle of the Atlantic largely due to the hubris of the German U-boat Command, which never did appreciably change its radio procedures or frequencies.

5. Anti-Submarine Operations Research Working Group (ASWORG)

ASWORG was established under the authority of the National Defense Research Committee (NRDC) on April 1, 1942. As previously noted, it was specifically designed to accomplish an analytical study of the German U-boat "problem" being faced daily by Allied merchant vessels operating in the Atlantic. U.S. Navy Captain Baker—who

persuaded the Chief of Naval Operations (CNO) to allow the NRDC to establish ASWORG—described the requirement of such a group to be staffed with top civilian scientists by quoting a memorandum circulated through the British Coastal Command. The memorandum advised recruiting not only those who have attained "the very best standing in science," but also those with demonstrated analytical ability: "…gifted mathematicians, lawyers, chess players, etc." (Sternhell & Thorndike, 1946).

ASWORG represents one of the first uses of Operations Research (OR) to specifically define and provide solutions to Navy problems. It is noteworthy that the CNO initially resisted the initiative, largely due to his faith in the established anti-submarine warfare doctrine in use at the time—and in spite of the mounting evidence of that doctrine's inadequacy. This also would not be the last time an emulation of British ideas resulted in an effective wartime change.

6. Naval Doctrine and the Aircraft Carrier

During the course of the war, the aircraft carrier overtook the battleship as the U.S. Navy's primary means of projecting combat power. This change was not due to any single individual, but rather a series of incremental improvements to aircraft ranges and armaments. As the U.S. Navy's official post-war analysis concluded, the nature of warfare at sea evolved such that by war's end, it was clear that "Control of the air was prerequisite to control of the sea." Drawing on lessons from the Pacific theater, it further concluded that local control of the air permitted the landing of amphibious forces and the subsequent construction of facilities necessary to enable sustained strategic targeting of the enemy's war making apparatus (Office of the Chief of Naval Operations, 1947).

At the outset of World War II, the warfighting potential of the aircraft carrier and naval aviation in general was largely underestimated (Till, 1996). Aircraft carriers had been initially integrated into the existing naval doctrine, primarily in the role of providing airborne scouts for the existing fleet concept. Through a masterful blending of political maneuvering, resource grabs, and the establishment of a new promotion pathway, Admiral James Moffett ensured carrier aviation continued to advance in spite of an existing culture that heavily embraced the battleship as the traditional center of sea power

(Pierce, 2004). He and a few other key officers believed in the enormous potential of the carrier to dominate the seas, but on the day of the attack on Pearl Harbor, the U.S. Navy operated only eight aircraft carriers—equal to the number of British carriers afloat and two fewer than Japanese (J. Ellis, 1993).

The Japanese raid on Pearl Harbor no doubt affected the U.S. Navy's view of sea power. Between December 7, 1941 and April 9, 1942, the Japanese carrier striking force sank five battleships, one aircraft carrier, one cruiser, and seven destroyers. More importantly, it had struck across an area one-third the earth's circumference and had done so while rarely being sighted or effectively counterattacked (Office of the Chief of Naval Operations, 1947). During subsequent clashes with the Japanese fleet, only the American aircraft carriers could provide the reconnaissance and striking power to effectively counter and eventually defeat it. The production of new carriers was both increased and accelerated. By 1943, there were 50 carriers of three different types in service. By October 1945, the U.S. had placed in service 137 carriers (including those produced for and leased to the British Navy) (Office of the Chief of Naval Operations & King, 1946). While it could not have gained such a capability without the dedication and sacrifice of "product champions" like Admiral Moffett, the combat results achieved in the Pacific are what firmly entrenched the aircraft carrier into its prominence in the new naval order.

7. Amphibious Operations Doctrine

The U.S. entered World War II without an established capability to conduct complex amphibious assault landings. Although the U.S. Navy was aware of the difficulties inherent in amphibious operations, only the U.S. Marine Corps was sufficiently fixated on the problem to develop the doctrine necessary to address them. It was also, however, U.S. Marine Corps' need to sufficiently differentiate itself and its mission from the Army that drove it towards amphibious operations. In 1933, shortly after the Department of the Navy remade the Marine Corps Expeditionary Force into the Fleet Marine Force, Army Chief of Staff General Douglas MacArthur renewed the argument for absorbing the Marines into the Army (Lorelli, 1995). The Marine Corps School, at the direction of Marine Commandant Ben Fuller, developed and published the

Tentative Manual for Landing Operations in January 1934. In 1938, the minimally revised document was adopted by the U.S. Navy and published as *Landing Operations Doctrine.* Soon thereafter, the U.S. Army adopted it verbatim; it was minimally revised in 1941, 1942, and 1943, but the central principles laid out by the Marines in 1934 had been proven sound and were left intact (Lorelli, 1995).

In October of 1940, President Roosevelt directed the Chief of Naval Operations and the Secretary of the Navy to develop a plan to cooperate with the British in the event the U.S. was to enter the war against Germany. The subsequent plan called for large numbers of American troops to be transported across the Atlantic to invade the European continent (Lorelli, 1995). Amphibious operations instantly became a critical component of Allied strategy in Europe.

Unfortunately, the existence of a doctrine publication and a war plan do not make for military capability. Even though the commitment level of the Marines was high, the Navy was not configured to execute such amphibious assaults. Earnest preparations for amphibious war had begun some five years prior, in 1935. Each year the Navy and Marines conducted an amphibious exercise and each year, the same deficiencies in equipment, training and manpower were noted (Smith, 1992). It was not until the prospect of war loomed ahead that the acquisition of sufficient amphibious vehicles and additional forces was pursued.

The Marines found themselves putting doctrine into practice in 1942. While far from perfect, the early amphibious assault on the island of Guadalcanal proved the fundamental concepts sound—in no small part due to the initial lack of enemy resistance. However, the amphibious force hit snags, even unopposed. The landings at the neighboring islands of Tanambogo and Gavutu provided the marines with their first real resistance, which varied from isolated sniper fire to coordinated fires from fortified positions along the landing zone. Among the key lessons absorbed from the protracted combat there was the importance of planning for adequate logistical support and the need for improved coordination with air support assets (Lorelli, 1995).

Perhaps the most punctuated lesson of amphibious warfare came not from direct combat but from the experience of the Canadian and British failed amphibious assault at Dieppe. The U.S. Marines had emplaced an observer with the force, whose observations would further improve the effectiveness of American amphibious assaults. Among them were (1) air superiority was a requirement; (2) the need for shore bombardment outweighed the need for surprise; (3) shore-based naval gunfire spotters were necessary; (4) dive bombing was a superior tactic for reducing shore defenses; (5) successful withdrawal was a virtual impossibility for an amphibious force (Lorelli, 1995).

Amphibious doctrine—like other doctrines of the period—evolved iteratively. With each successive battle, equipment and techniques were refined. During the earlier battles, such as at the bloody fighting at Tarawa, voluminous lessons were collected which resulted in numerous adjustments to critical components, such as communications plans, shore bombardment, and landing craft types and numbers, etc. (Lorelli, 1995). The fundamental concepts, however, did not change appreciably during the course of the war. Though experience generated improvements to equipment and tactics, the nature of amphibious operations was such that even after two years of conducting them, they still involved a high numbers of casualties against a prepared enemy.

8. Amphibious Craft

The six annual Fleet Landing Exercises conducted between 1935 and 1940 were characterized by the testing, experimenting with, and refining amphibious tactics and doctrine under conditions that represented the best the Marines could do to simulate combat. Each annual exercise was characterized by several limitations in available personnel and equipment, indicative of the relatively low priority given to amphibious craft operations within the U.S. Navy prior to the start of the war. Perhaps the biggest limitation the Marines and Navy faced upon entry into the war was the "…total lack of assault transport vessels, [and] the very limited number of landing craft…" (Smith, 1992). This deficiency would soon be remedied, however, as landing and amphibious craft were reprioritized amongst the competing U.S. shipbuilding requirements. By August 1945, some 56,000 amphibious craft would be built (Ladd, 1976).

The existence of an amphibious ship capable of landing tanks directly on the beach was observed in use by Japanese forces and reported to the Department of the Navy by Marine Lt. Victor Krulak while serving in China in 1937. Not surprisingly, his report generated no action. Two years later, back in the U.S. and serving under General Holland Smith, Krulak carved a model of the landing craft he had witnessed in China and showed it to Smith. Smith took him and his idea to the Commandant of the Marine Corps, and the next two years would see numerous disputes between the Marines and the Navy concerning the details of the craft necessary for amphibious operations (Lorelli, 1995). Through sheer force of personality and tenacity, General Smith and his core of proponents succeeded in getting their ideas for ship designs into Navy inventory. However, it was not until both President Roosevelt and Prime Minister Churchill came to an agreement on overall strategy in Europe that the construction of sufficient amphibious and landing ships was reprioritized high enough to produce the required numbers of craft.

9. Office of Strategic Services (OSS)

In the years leading up to the second world war, the intelligence capabilities of the U.S. government were fractious and focused largely at internal espionage threats. Four primary agencies collected intelligence: the Department of State, the Federal Bureau of Investigation (FBI), the Office of Naval Intelligence (ONI), and the Department of the Army's Military Intelligence Division (MID). The overseas presence of these agencies was minimal, coordination amongst them was non-existent, and no reliable means existed for ensuring the most important intelligence was forwarded up the chain to the White House (O'Donnell, 2004).

In an effort to improve the quality of the intelligence he received, President Roosevelt directed the establishment of the White House agency known as Coordinator of Information (COI). Its mission was to improve the analysis and dissemination of critical intelligence matters for the president. President Roosevelt chose retired General and practicing attorney William J. Donovan to lead the new office. Almost immediately, his authority and organizational mission were challenged by the existing intelligence agencies in an attempt to repel his invasion into what they saw as their "turf." Donovan,

in an attempt to allay the distrust of the newly created Joint Chiefs of Staff, suggested to the president that COI be transferred to report directly to the joint chiefs (O'Donnell, 2004).

Donovan's proposal was accepted, and in June, 1942, COI was officially redesignated the Office of Strategic Services (OSS). Donovan patterned the organization after the British intelligence and special operations community, to which he was given unprecedented access by Prime Minister Churchill. The functions of the OSS were carried out by divisions: Research & Analysis (intelligence), Research & Development (weapons), Morale Operations (subversive propaganda), Maritime Units (agent/supply transport and sabotage), X-2 (counterespionage), Secret Intelligence (covered field agents), Special Operations (sabotage, subversion, guerrilla warfare), and Operational Groups (sabotage an guerrilla warfare teams with language expertise) (O'Donnell, 2004).

Over the course of the war, the OSS—under the tutelage of its British counterparts in MI-6, Secret Intelligence Service (SIS), and Special Operations Executive (SOE)—pioneered what would become the institutional foundation for American intelligence operations for the rest of the century (MacPherson, 2003).

10. Office of Scientific Research and Development (OSRD)

The OSRD was established by Executive Order 8807 on June 28, 1941 with the primary mission of "assuring adequate provision for research on scientific and medical problems relating to the national defense" (Woolley & Peters). As a follow-on organization to the former National Defense Research Committee (NDRC—which by EO 8807 became subordinate to the OSRD) it was also concerned with the application of new science and technology applications for the defense of the nation. However, the OSRD's charter also included several significant duties that indicate the kind of influence it, and its director, Vannevar Bush, wielded with the president. First, the director of the OSRD reported directly to President Roosevelt, allowing for significant bypassing of barriers to carrying out its mission. Next, the director was authorized to organize OSRD as he saw fit (he still had to get his department heads approved by the president).

Most significantly, the director had the authority to take over any contracts and obligations previously entered into by the NDRC. Effectively, the OSRD was given the authority to modify and manage previously existing contracts, seek out new scientific applications for defense and medicine, and mobilize the nation's scientists to focus on wartime problems. The director had the access to the president that allowed him to apply pressure if needed to gain the compliance of the agencies involved—primarily the Departments of the Navy and War (Woolley & Peters).

Vannevar Bush quickly organized OSRD into cross-functional divisions that were built to specifically address the unique warfighting and medical problems confronting the nation in 1942. One of the attributes that made OSRD so effective was Director Bush's adherence to the principle of flexible organization; he organized by task, and hired specific expertise for each task as it evolved. As one might expect from this type of organization placed in a position of power, not everyone was thrilled about having the OSRD meddle in what they felt was their business (Shachtman, 2002).

11. Airborne Doctrine and the Airborne Division

The U.S. Army first explored the use of the parachute in the 1920's, but after a series of inconclusive trials, the idea faded. It was after the Germans' highly effective use of both parachute and glider-borne forces in 1940 that the U.S. Army grasped the potential utility of airborne forces. The War Department directed the formation of a parachute test platoon and ordered its commander, Major William Lee to assess means of delivering troops into combat through the use of the parachute (Weeks, 1978).

By May 1941, the U.S. Army's airborne capability consisted of one parachute infantry battalion. Furthermore, no doctrine existed to govern its employment. During pre-war exercises, the airborne was used as a suicide force, many times given no means or plan to link up with main forces during the operation. To make matters worse, the parachutes used during this period did not allow individual airborne soldiers to jump with their weapons on their person (Sheehan, 2003).

It was only after the Germans won a hard-fought, airborne assault on Crete during this time period that the U.S. Army became serious about the employment of airborne

forces in support of strategic objectives. The perception among U.S. Army airborne proponents was that the German victory at Crete was easily achieved. In reality, it was a near catastrophe that caused the Germans to re-think their airborne employment doctrine (Sheehan, 2003). U.S. airborne capacity was rapidly expanded as a result.

Beginning almost immediately following the German actions on Crete, the Chief of Staff of the Army, General George C. Marshall, directed the formation of three more parachute infantry battalions. Following that, he established two experimental airland battalions. After the attack on Pearl Harbor, he authorized a total of six parachute infantry regiments, each composed of three battalions. Growth continued through 1942, until the U.S. Army had four airborne infantry divisions before Allied operations began at Sicily (Sheehan, 2003)

The rapid expansion produced chaos. Airborne doctrine had yet to be fully thought-through, much less tested in combat. The air component of the airborne, the USAAF Troop Carrier Command (TCC) was chronically short of aircraft and new deliveries were slow to materialize. Therefore, it was difficult for newly formed airborne troops to exercise and refine their tactics and doctrine. In an effort to fill the gap left by aircraft shortage, the War Department elected to explore the use of gliders (Sheehan, 2003).

The airborne force tasked to jump into Sicily, which marked the first large-scale allied airborne employment, suffered all the symptoms of an ad hoc military unit. The most critical shortcomings were the lack of unity of command between the airborne ground force and the troop transports, and the lack of aircrew training for operations at night—when the assault occurred. Paratroopers landed as far as 60 miles from their drop zones in some cases, and the force was dispersed over Sicily in handfuls. They were forced to join up on the ground with whomever they could find and begin to conduct operations against the enemy. Adding insult to the lackluster airdrop, transport aircraft were fired upon multiple times by Allied naval forces operating in the vicinity (Sheehan, 2003).

Though ultimately successful, the drop into Sicily provided numerous and significant lessons with which the airborne units could modify their doctrine and tactics. It also helped airborne proponents define the appropriate missions for such a force. Additions to the next revision of the airborne doctrine manual included prescribing the use of airborne troops in the enemy's rear to create confusion and act as a diversion to the main force, the seizure and holding of key terrain arrear of organized beach defenses, and consolidating gains made until the arrival of the main force (Sheehan, 2003). Furthermore, the command relationships and procedures by which coordination was accomplished were improved. Specially trained pathfinder crews were designated to lead formations to ensure accurate placement of troops over the correct drop zones (Sheehan, 2003).

Much like the other doctrines presented in this study, airborne doctrine evolved through a cycle of trial-error-correction that persisted through the end of airborne combat operations. By 1944, Allied forces conducted corps-sized airdrops, and while they experienced difficulties, the airborne forces had effectively found their niche in combined-force operations and were employed accordingly. Furthermore, the procedural issues that marred the early drops were substantially reduced (Warren, 1956).

12. The Glider and the Parachute

The U.S. Army Air Force was effectively forced into emulating the German use of the glider as an airborne assault vehicle when the rapid expansion of the Army's airborne forces outpaced the AAF's transport aircraft procurement schedule. First used in combat in the 1943 assault on Sicily, the glider saw action through the remainder of the large Allied airborne offensives (Polmar & Allen, 1991).

The primary U.S. combat glider was the Waco CG-4A. Though it proved effective at Sicily, the nature of the glider in general made it a sub-optimal choice for a combat transport vehicle. It was constructed out of steel tubing and covered with fabric, and therefore provided little to no protection to its passengers. Also, it had only one entrance/exit, which was the hinged nose. During a crash landing, the nose was invariably damaged, trapping the passengers and cargo inside (Warren, 1956). Despite its

limitations, the glider did possess one attribute in which it was superior to the parachute: troops and equipment were far less prone to the tremendous dispersion that paratroopers frequently experienced.

13. Mounted Cavalry

During the lead-in to the war, the Army had to determine what, if any, role the horse would continue to play in cavalry units. Many in the cavalry favored full mechanization, but others advocated a mixed horse and mechanized cavalry configuration. And of course, others advocated the sole use of the horse (Stubbs & Connor, 1972). Reconfiguration of the cavalry meant not only changing its mode of transport, but also of its doctrinal mission and how it integrated with the other combat forces.

The decimation of Polish horse cavalry units in 1939 no doubt had an effect on the thinking of U.S. Army leadership at the time. The last Chief of Cavalry, Major General John K. Herr, testified before congress that some missions would be best accomplished using mechanized forces, others best accomplished by mounted forces, but "on the whole, the best results can be accomplished by using them together" (Stubbs & Connor, 1972). The paradigm shift from horse-mounted to mechanized was not a smooth one.

Of the two cavalry divisions active during the war, only one—the First Cavalry Division—fought as a unit. It saw combat in the Pacific, but as dismounted infantry. The other was partially deactivated, served in North Africa (again, without horses or vehicles) and ultimately completely deactivated in 1944. The non-divisional cavalry units were completely mechanized during the war, and a period of significant organizational restructuring followed. At the same time, the War Department directed cavalry units to train primarily for reconnaissance missions employing infiltration tactics, fire, and maneuver. Subsequently, many cavalrymen felt the reorganization and change to mission severely wasted capacity to engage the enemy alongside the main force using armored vehicles (Stubbs & Connor, 1972).

14. Combined Arms Doctrine

After witnessing the effectiveness of Germany's combined-force offensive, or *Blitzkrieg*, the U.S. Army began to reconfigure its combat arms organizations. American armor capability at the time was minimal, but General Marshall ordered the completion of scores of tanks and the creation of the Armored Force. The first two armored divisions, created in July, 1940 consisted of an armored brigade composed of two regiments of light tanks, a regiment of medium tanks, a regiment of artillery (two battalions), and an engineer battalion. The infantry component of each division was a single two-battalion regiment of "leg" infantry and a motorized reconnaissance battalion (Corbett, 2001).

However, armor units remained distinctly separate entities from infantry and artillery. Though some coordination and integration training was accomplished by forces taking part in pre-war exercises, the doctrine of the U.S. Army looked much like it did at the end of World War I. Combined arms units did not exist, and combined arms missions were difficult to coordinate or standardize. The first step towards remedying this situation came during the fighting in Normandy, where each branch served a useful purpose in support of the other. Infantry swept ahead of the armor to screen for fortified positions. Armor and artillery provided the necessary firepower with which to destroy fortifications and therefore advance. As the fighting continued, the ad hoc doctrine was gradually replaced by best practices. These lessons were eventually compiled and formalized into a doctrine publication in November, 1944 (Corbett, 2001).

15. The Bazooka

General Dwight D. Eisenhower named the bazooka as one of the four key weapons that helped most to win the war (Polmar & Allen, 1991). It is not surprising, then that the innovation of the bazooka was not the product of an Army development process. Instead, the idea came from a colonel and rocket-hobbyist working alone at the Aberdeen Proving Grounds, trying to make small rockets militarily useful. He initially succeeded to the point of being able to shoulder-fire a small rocket (Weeks, 1975).

The problem was no suitable warhead existed that could do significant damage to an armored target. That is, until a Swiss designer developed a hollow-charged grenade in

1940 and later brought it to the U.S. in hopes of selling the design (the British had already turned it down). When combined with rocket propulsion, it could disable an armored vehicle. Furthermore, it was simple, relatively lightweight, easy to aim, and highly effective. Once the prototype had been demonstrated on a test range, the commander of Ground Force Development ordered it into pilot production without further tests. Soon thereafter, in May 1942, General Electric was put on contract to produce 5,000 units within 30 days (Weeks, 1975). Another, more ominous indicator of its utility was the fact that the Germans captured a bazooka from the Russians and subsequently copied it, producing a weapon called the *panzerfaust* ("tank fist"). By the end of the war, 476,628 bazookas and 15,603,000 rockets had been produced (Chamberlain & Gander, 1974).

16. Hedgerow Warfare

Following the tremendous effort to establish a foothold at Normandy in 1944, Allied forces found themselves unable to proceed inland and continue their advance across France towards Germany. Hindering their progress inland was a unique combination of enemy and terrain for which they were thoroughly unprepared. The maze-like terrain features consisted of earthen berms supplanted with vegetation—hedgerows used by farmers to divide land and prevent soil erosion—provided German defenders excellent cover and concealment. They all but stopped off-road tank movement, and prevented Allied forces from being able to observe (and therefore adjust) mortar and artillery fire (Doubler, 1994).

Progress through the Normandy hedgerow system was so slow, it took General Bradley, the First Army commander, a full 30 days longer to advance his forces inland to the vicinity of St. Lo than Allied planners had estimated prior to the invasion. In retrospect, those involved identified two other factors besides the terrain that slowed their progress: the tenacity of the German defenses and problems with their own organizations (Doubler, 1994). By the end of June 1944, infantrymen in the First Division were clearing one hedgerow field at a time, advancing a few hundred yards through each one,

many times in narrow columnar formations. Commanders quickly became painfully aware of the deficiencies in their own combined-arms coordination procedures and training.

The key to gaining the advantage in the hedgerows, or *bocage*, was to regain the ability to maneuver supporting armor quickly and place effective firepower on the German defensive positions. Dozer tanks were effective at pushing through the hedgerows, but First Division had only four such tanks. One unit, the 747th Tank Battalion (assigned to the 29th Infantry Division), did not possess the dozer variant; instead its men improvised explosive charges to blow gaps in the hedgerows large enough to drive tanks through. Unfortunately, the number of hedgerows, tanks, and size of explosive required to create gaps large enough combined to create an enormous requirement for explosives—one that could not be supported. As a result, one member of the 747th came up with the idea to bury the explosive in the berm, which required less explosive to achieve the same results.

As digging and burying explosives in root-strewn berms was time consuming and extraordinarily dangerous when done under fire, a tank crewmen improvised a mechanical device that enabled M4 “Sherman” tank crews to simply ram a hedgerow berm and gouge out a hole for the explosive charges. As their advantages became apparent, these improvised modifications both spread in use and increased in sophistication and functionality. Larger, toothed bumper-like devices fashioned out of scrap iron salvaged from German roadblocks became commonplace. Eventually, General Bradley got word and attended a demonstration, after which he immediately ordered the production of as many hedgerow-cutter devices be produced as possible (Doubler, 1994).

Equipment modifications alone were not sufficient to overcome the advantage of the defenders. Coordination required between infantry units and tanks was previously unimportant; in the *bocage*, it became critical as tankers and infantrymen attempted to coordinate their movements through the confined spaces of the hedgerows. Following a failure to breach German lines and the loss of four tanks on July 20, the 29th Division’s leadership fell back and re-thought its approach to the problem. Several changes were proposed and attempted in an effort to improve coordination. Tankers added interphone

modifications to allow infantrymen to talk to a crew inside a tank without exposing themselves to hostile fire. Infantry units procured additional compatible radios. Most importantly, infantry and tank units began to rehearse coordinated action behind the front lines of advance, developing hand signals and refining their tactics as they went (Doubler, 1994).

Several more changes had to take place before a sufficient advantage existed to overrun German positions consistently. They included the use of aerial-observed artillery fire and the further refinement of combined armor-infantry tactics (Doubler, 1994). What is significant about this example is that by themselves, the individual changes made within First Army would not have likely been effective enough to make a significant difference in the pace of the Allied advance. It was only through the continuous experimentation and refinement that solutions presented themselves, or *emerged,* from distilling the results of actions against the enemy. Furthermore, battalions and divisions developed their own solutions to their unique deficiencies. To be sure, the Allies would have likely been able to push enough men and tanks towards the problem that they would have eventually made it through hedgerow country. The "hedgerow combat doctrine" developed in Normandy may not have been decisive, but it no doubt hastened what could have been a much more costly advance in terms of both time and lives.

17. Close Air Support

At the outbreak of World War II, airpower doctrine had drifted significantly from that of "close support" to ground forces that had evolved during World War I. The mission of supporting ground forces was still paid lip service by the Army Air Corps (later the Army Air Force—AAF), and in practice the capability was non-existent. By 1941, U.S. and Allied airpower was heavily committed to the doctrine of strategic bombardment (Syrett, 1990). Subsequently, as U.S. tactical air units entered the war in 1942 in support of the ground campaign in North Africa, the initial results were dismal. To make matters worse, senior commanders of the air and ground components heatedly debated the issue of exactly who should be in command of aircraft executing strikes on targets required by—and in close proximity to—ground forces.

In an attempt to provide some guidance to those dealing with the problem of how best to go about supporting ground operations with airpower, the War Department published FM 31-35, *Aviation in Support of Ground Forces* in April of 1942, which was based largely on the experience of the Allied operations in Europe prior to American entry into the war. The War Department also formed new organizations, the air support commands, to specifically carry out the mission of supporting ground combat (Syrett, 1990).

The concept of the air support command was the first step towards creating an effective Allied close air support capability—it effectively formalized the notion that air operations in support of ground forces were important enough to dedicate a portion of the theater's aircraft to them. However, this organizational change was far from sufficient on its own. Multiple supporting air "commands" existed within the same theater, several of which fell directly under army ground commanders, such as the XII Air Support Command, which was subordinate to Major General George S. Patton, Jr., Commander of the Western Task Force. To make matters worse, the coordination mechanisms spelled out in FM 31-35 relied heavily on airmen placed in liaison positions at key levels of the ground force's chain of command, but ultimately left the approval of air support missions in the hands of the ground force commanders (Syrett, 1990). The net result was highly uncoordinated air attacks against targets of sometimes questionable priority.

Most airmen saw the need for centralization. Key among them were Major General James Doolittle, commander of Twelfth Air Force, and Air Chief Marshal Sir Arthur Tedder, Air Officer Commander in Chief, Middle East. Conversely, ground force commanders believed the only way to increase the effectiveness of close support missions was to place all air support aircraft directly under the command of their supported ground force commander. The squabbling between commanders did little to improve the situation. Lieutenant General Dwight Eisenhower, as the Supreme Allied Commander of Operation Torch, was well aware of the poor performance of airpower during the invasion of North Africa. Soon thereafter, he appointed Major General Carl

Spaatz commander of all Allied air forces in Algeria and Tunisia. Spaatz, in turn, reapportioned more assets to the XII Air Support Command in hopes of improving close air support results.

However, effective coordination and tactical results remained elusive, and, following a meeting with General Eisenhower, Spaatz created Allied Air Support Command in an effort to exercise centralized control of limited close air support forces (Syrett, 1990). Subsequently, centralization enabled airmen to systematically assess requests, prioritize missions, and adjust them accordingly as the next day's efforts proceeded from planning to execution. Centralized control was, however, just the first step.

18. The Roles of Airpower

During the maelstrom of debate that surrounded the development of Close Air Support and the "proper" role of airpower, several key propositions about the employment of airpower resulted. As with any constrained resource, there must be a guiding method governing how its use is most efficiently directed. After many failed attempts, Allied commanders finally embraced three key roles for airpower: strategic bombardment, air superiority, and close support of friendly ground troops.

The significance is that the AAF finally embraced a doctrine that was proven effective in battle, but it was not codified in an actual FM until 1945. Again, many beliefs held by both air and ground commanders prior to the outbreak of war were proven false, and the entire premise had to be re-thought, argued, and re-formulated while fighting one of the largest combat actions in world history. On more than one occasion, the debate had to be decided by the Allied theater commander himself. In these instances, those arguments that could be backed up by recent combat results carried the day.

It is clear the heavy emphasis on strategic bombardment within the AAC that developed in the pre-war years was very much a survival strategy for the airpower advocates. They simply needed a unique capability that would allow them to argue the need for increasing resources and—in the opinion of some—the need for a separate

military service. It is also clear that the nearly singular focus on strategic bombardment guaranteed an air component that was capable of little else at the outbreak of the war.

19. Daylight Precision Bombing

The strategic bombardment of German war manufacturing capacity was the default strategy of the U.S. Army Air Force—a foregone conclusion reached before a single U.S.-piloted bomber had touched down on an English airfield. In March 1941, the air campaign plan completed for the eventual entrance of the U.S. into the European theater—known as Air War Plans Division-1, or AWPD-1, for short—called for a strategic bombing campaign against Germany and Italy. Noticeably absent was the mention of support to or combined operations with either the army or navy. AWPD-1 was built with the belief that airpower would bring the German war machine to its knees by itself (Stokesbury, 1986).

It would be almost two years from that point until American bomber crews got the chance to put concentrated strategic bombardment into practice. The necessary diversion of air assets to support operations in North Africa had set Eighth Air Force and its commander, General Ira Eaker significantly behind schedule. During the wait, the small numbers of American crews executed small raids into France and generally got oriented to the theater. One must also assume that they witnessed the British strategic bombing effort—partially executed with American-supplied B-17s—and its subsequently dismal results throughout 1941-42. At the end of 1941, Royal Air Force Bomber Command began a scientific study of the effectiveness of their preceding bombing efforts. Its results concluded that fewer than one in three bombs dropped on German soil fell within five miles of their intended targets. The study highlighted the weaknesses inherent in the British doctrine of nighttime, “precision” (that is, aiming at singular structures instead of spreading bombs out over an area) bombing and raised serious doubts about Bomber Command’s efficacy (Stokesbury, 1986).

Nevertheless, Eighth Air Force believed it could achieve what the British could not, and continued with its plan of strategic bombing against German industry. What set the Americans apart—at least in their minds—was their technology: the U.S. version of

the B-17 had roughly twice the defensive capability of the export version and more importantly, it was equipped with the Norden bombsight, a device believed at the time to be a decisive advantage (Stokesbury, 1986). The Americans would not need the cover of darkness, as the superior defensive capability of the B-17G would be sufficient to keep losses to a minimum, even in daylight.

Following costly early missions over France in early 1943, the commander of the First Bomb Wing, General Haywood Hansell, attempted to improve his wing's results and reduce casualties by convening key commanders and aviators following each day's missions. Hansell was committed to learning from the experiences that were costing lives and machines. He recognized the key to learning quickly was "absolute honesty," and any topic was open for discussion *except* the abandonment of precision daylight bombing (Griffith, 1999). As one of the architects of AWPD-1 (and later AWPD-42, the updated combined war plan) Hansell was simply too invested in daylight precision bombing and what he believed possible through strategic bombardment to consider any other options at the time.

Deep-penetration raids into Germany began in August 1943 and continued through October. The losses inflicted on the bomber fleet by the German air defense network and the Luftwaffe were extremely high, and quickly recognized as unsustainable. One raid, executed October 14 against the industrial city of Schweinfurt, resulted in 60 bombers out of 291 airborne being destroyed. The loss of 600 aircrew in a single day punctuated the realization that bombers could not fly unescorted over Germany in daylight (Stokesbury, 1986).

Two significant changes were made in an effort to improve bombing results. The first was the switch from "precision" to "area" bombing tactics by the British. The second change came about with the completion of the P-51 "Mustang." Previous attempts to escort the B-17s with the longest-range, drop-tank equipped fighter available—the P-47 "Thunderbolt"—were only marginally successful, as the stout P-47 could not reach targets deep in Germany, and the Germans knew precisely where the escorts had to turn back (Stokesbury, 1986). In June 1943, U.S. Assistant Secretary of War for Air, Robert A. Lovett, returned from a visit to Eighth Air Force headquarters, and ordered the

acceleration of the P-51 into service. It flew its first escort mission six months later, in December, and subsequent bomber loss rates dropped from 9.1 percent per mission to 3.5 percent (Polmar & Allen, 1991), effectively enabling the bombing campaign to continue attriting German production capacity.

The doctrine of precision daylight bombing was the default answer to what American airmen viewed as the critical task at the time of entry into the war: to strike at the heart of Germany in an effort to crush its national will to fight. What is remarkable is the sheer number of bombers and crews that had to be lost before a change in doctrine or technology was sought. In essence, the strength of the idea put forth by those airpower pioneers who effectively staked the future of an independent air force on its ability to wage war by itself could only be swayed by operational results so poor and costly that their very existence was threatened.

20. Norden Bombsight

Though widely thought of as the U.S. bomber fleet's "secret weapon," the Norden bombsight was first fielded on U.S. Navy aircraft in 1931. It was not until 1941 that it was adopted for use by the U.S. Army Air Force and eventually installed on about three-fourths of the U.S. bomber fleet (L. Searle, 1989). While the bombsight marked a significant step forward in solving the fundamental problems with accurately placing bombs on target from high altitudes, the secrecy and hype that surrounded it were far more effective at keeping it in service than was its actual performance. As it was based on high-power optical lenses, it was ineffective if the target was obscured by clouds—an obvious problem for operations taking place in Europe. In addition, the accuracy of the bomb delivery required a straight, non-maneuvering final leg to be flown to the target, which was easily attainable in training but many times impossible in combat due to enemy fighters and flak (Shachtman, 2002).

The true significance of the Norden sight is that due to its highly classified existence, the effects of its accuracy (or lack thereof) were never truly understood until after the war. At the time, it was believed to be one of the U.S.'s key advantages and its "Top Secret" classification prevented a more objective assessment. Another key factor

keeping the Norden sight in use was the fact that a superior competitor bombsight, produced by Sperry, was even more classified and therefore even less well known. Indeed, the very fact that Sperry had produced a bombsight was classified "Top Secret" and known only to a handful of the company's own employees (L. Searle, 1989). Thus, the combination of critical operational assessment data, over-classification, and the "mythical" status of the bombsight itself prevented any serious effort to attempt to improve on the Norden bombsight.

21. Nighttime, Low-Level Incendiary Bombing

Following the evolution of bomber tactics and doctrine in Europe from 1941-1943, General Curtis Lemay was determined to improve the results and further "prove" the worth of strategic bombardment in the Pacific theater in 1944. Due to its superior range, the newly produced B-29s were dedicated to the Pacific bombing campaign against the Japanese mainland. Operations were launched first from China in June 1944, and six months later, they were begun from newly constructed airfields on the Marianas islands. By January 1945, both B-29 units were conducting operations against specific, strategic targets during daylight, and both units were achieving poor-to-marginal results (T. R. Searle, 2002).

There was very real fear that the failure of the B-29 to achieve any significant strategic results against the Japanese amounted to yet another indictment of the validity of strategic bombardment. The Chief of the Army Air Force, General Henry H. Arnold, fired the commander of the Mariana operation, General Hansell, then consolidated the B-29s from China to the Mariana Islands and charged General Curtis LeMay with getting results from the B-29 fleet (T. R. Searle, 2002).

After two months of no significant change, General LeMay tried switching to incendiary bombing—perhaps based on his previous experience in the European theater. He directed changing the weapons payload but keeping the high-altitude delivery profile. The results were only slightly better. By March 1945, LeMay realized the high winds aloft made effective use of the Norden bombsight impossible, and directed a switch to a low-altitude, single-file procession of B-29s across a target city using incendiary

weapons. To negate the additional threat of the low-altitude attack, he dictated the missions be flown at night (T. R. Searle, 2002).

The results were devastating. A firestorm begun initially in the Shitamachi district of Tokyo ultimately burned 16 square miles of the city to the ground, producing an U.S. estimated (and acknowledged to be low) 80,000 casualties. LeMay continued the practice until his force was out of incendiaries. Eventually, bombers dropped leaflets first, warning of such an attack. This allowed the population to leave the city before it was devastated by the bomber force (Stokesbury, 1986).

Notably, General LeMay felt the need to keep his change in tactics a secret from his superiors prior to the mission—presumably due to the fear he would be overruled and prevented from implementing them. He was only able to bring about this change after he took personal risk by eschewing the established doctrine.

22. Unmanned Bombers

In an effort to stem the loss of life in the air during the strategic bombardment campaign, the USAAF undertook a project to deliver ordnance to key strategic targets by remotely piloting bombers. Project Aphrodite used both remotely piloted U.S. Navy Catalina and USAAF B-17 medium bombers. The basic concept was that a minimal crew got the plane airborne, but then bailed out before crossing the English Channel. The unmanned aircraft was then flown remotely by a pilot in another B-17. The remote bomber, laden with upwards of 25,000 pounds of explosives, would then be steered directly into a heavily-defended target (McDaid & Oliver, 1997).

All totaled, 12 attempts were made at attacking German V-weapons sites with Project Aphrodite aircraft. Only three made it to the vicinity of the target and each caused relatively little damage. The remaining nine exploded enroute, uncontrollably disappeared, or were shot down by German defenses in the target area. During the handful of combat trials, several aircrew lost their lives due to malfunctioning remote aircraft (Armitage, 1988). The project illustrates the lengths to which the U.S. would go in an attempt to reduce the number of bombers being lost during the combined bomber offensive.

23. Marine Raiders

In February 1942, two battalions of U.S. Marines were designated "Raider Battalions"—the First and Second–by the Commandant of the Marine Corps, Major General Holcomb (Hoffman, 1995). How the Commandant reached the decision to create the battalions is somewhat complex. No fewer than three individuals, working separately, made appeals to their respective "higher-ups." The first, Captain James Roosevelt, the President's son, wrote to General Holcomb to urge the creation of a commando unit capable of waging guerrilla warfare—similar to that which Roosevelt's friend, Major Evans Carlson (USMC) had witnessed in China as an observer there in 1937. At the same time, William Donovan, later to become Director of the OSS, wrote to President Roosevelt about his idea to create a unit capable of guerrilla warfare and assisting partisans behind enemy lines. And finally, Major General Holland Smith, USMC, and commander of Amphibious Force Atlantic Fleet (AFAF) developed the concept by designating a single Marine battalion a "special battalion," and subsequently using it to stage landings to seize key terrain in advance of a main amphibious force. In early January 1942, General Smith wrote to the Commandant requesting he re-designate the battalion in recognition of its special purpose (Hoffman, 1995).

One can only speculate that the suggestions of two distinguished Marines combined with the interest of President Roosevelt made the decision to create the two battalions an easy one. The only resistance—albeit short-lived—to the idea came from General Holcomb himself, whose initial response back to Captain Roosevelt suggested that existing Marine units could accomplish the proposed missions (Hoffman, 1995).

The Raiders saw their first combat on Makin Atoll in the Gilbert Islands in August 1942. Raider Battalions would see combat throughout the Pacific, to include the campaigns in the Solomon Islands and New Guinea, primarily operating in support of Marine Divisional assaults. However, the Raiders gained notoriety for executing daring, autonomous raids and guerrilla campaigns behind Japanese lines. The Raiders would eventually expand to four battalions, but in February, 1944 the Raider battalions were combined and converted from "Raiders" into the Fourth Marine Regiment, its mission and composition that of the standard regiment of the time (Polmar & Allen, 1991).

24. Long-Range Escort Fighters

When General Spaatz asked Hermann Goering, soon after his capture, when it was that he first realized that the Nazis were defeated, Goering replied, “When I saw your bombers over Berlin protected by your long-range fighters, I knew then that the Luftwaffe would be unable to stop your bombers. Our weapons plants would be destroyed; our defeat was inevitable” (Frankland, 1968). Though obvious now, the solution to the problem of the Luftwaffe and its devastating effects on Allied bomber formations was anything but obvious in early 1943, when the Combined Bomber Offensive was just getting underway.

The first attempt at reducing bomber losses took the form of increasing the armor and firepower of a handful of B-17s and B-24s in the belief these “escorts” could protect the bomber formations. The results were “disappointing.” Subsequently, similar employment suggestions were made about both B-25s and B-26 medium bombers, but were rejected by Eighth Air Force (Boylan, 1966). It was not until March1943, that a fighter capable of escort arrived in theater—the P-47 “Thunderbolt.”

The P-47 also had a somewhat limited range, though it was better than the existing P-39s and P-40s it was designated to replace. Even before the P-47 arrived in theater, Eighth Air Force staff raised concerns about the need for a drop-tank capability to extend the range of the fighter. Difficulties in coordination with supplying units in the United States and confusion resulted in slow production and delivery. It was not until the spring of 1944 that drop-tank production matched demand (Boylan, 1966). In the meantime, P-47s escorted bomber formations along portions of the routes to their targets, but had to turn back before the bombers did due to fuel constraints (especially during missions deep into Germany). The Luftwaffe knew the combat radius of the P-47, and simply waited beyond the range for the bomber formations (Stokesbury, 1986).

In June 1943, Assistant Secretary of War, Robert Lovett, returned from an inspection trip to Eighth Air Force and promptly informed the Chief of the Air Force that fighter escort was the only effective means by which to protect bombers. He also indicated that the P-47 could be suitable, if only it was fitted with drop-tanks. Lovett’s

news, combined with mounting bomber losses during the first half of 1943 resonated with General Arnold. He immediately directed his Chief of Staff that "…by January, '44, I want a fighter for all of our bombers from U.K. into Germany" (Boylan, 1966).

Modifications to the P-47 configuration continued, to include 75-gallon and 200-gallon varieties, but the extra range produced was still not enough to escort bombers deep into Germany. In November 1943, shortly after two disastrous raids against Bremen and Schweinfurt, twin-engine P-38 "Lightnings" arrived in England and improved the escort capability but were small in number. After the October losses, General Arnold directed all P-51s coming off the production line be sent to England, and by December 1943, the P-51 (equipped with two 75-gallon drop-tanks) was in combat (Boylan, 1966). Proof of their effectiveness came in February, as P-51s escorted bombers deep into Germany in a maximum effort against German aircraft manufacturing, known as "Big Week," during which bomber losses were held to a minimum.

25. Air Commandos

As with so many airpower initiatives of World War II, the Air Commandos grew out of the ideas of General Henry H. Arnold. The original requirement for support to British General Orde Wingate's irregular fighters operating in China was narrowly specified as resupply and evacuation of his wounded. However, Arnold viewed the situation as yet another opportunity to advance the cause of airpower. He expanded the concept initially to include the provision of a small strike force, but soon after told his chosen leaders for the task force, Lieutenant Colonels Alison and Cochran, to "go over and steal the show" (Boltz, 2001).

The secret unit known only as "Project 9" grew to approximately 450 people and acquired CG-4A troop gliders, P-51s, L-1/5 light observation aircraft, C-47s, UC-64 transports, B-25s, and YR-4 helicopters. By January 1, 1944 the unit—re-designated the 5318th Provisional Air Unit—had arrived in India. Soon thereafter, they were re-designated the First Air Commando Group, and began preparations for what would be the covert invasion of Burma to interdict Japanese supply lines (Boltz, 2001).

D. ANALYSIS

	Nature of Change		
Effect of Change		Incremental	Transformational
	Minor	SONAR HF/DF Systems 10cm RADAR Hedgerow Combat Modifications Norden Bombsight Mounted Cavalry	Parachute / Glider Unmanned Bombers Marine Raiders Air Commandos Daylight Precision Bombing[1]
	Major	CAS OSRD Nighttime, Low-Level Incendiary Bombing Amphibious Operations Long-Range Escort Fighters	Bazooka Carrier Doctrine OSS Specialized Landing Craft ASWORG ASW Doctrine Airborne Operations Armor Doctrine Airborne Divisions
[1] Before the addition of long-range escort fighters to the bombing effort			

Table 3. Level of Effects and Nature of Changes

In analyzing the changes made by the U.S. military during World War II, it is the aim of this study to understand what conditions brought about each change. It is also important to assess the effects of those same changes on the overall war effort in order to take make general observations about how the most significant changes of the war came into being. To that end, the effect of each change is categorized as either "major" or "minor." A change is assessed as having a "major" effect if the results of the implementation of that change: (1) improve the strategic situation, (2) reverse the course of a major operation (such as Operation Overlord, the Allied invasion of France) or campaign, or (3) enable a previously unobtainable objective or strategy. Otherwise, the change is assessed as "minor" (See Table 3).

Similarly, the essence of each change is assessed. Changes in the form of modifications to existing equipment, concepts, tactics, etc. are considered "incremental." Changes that create previously unemployed tactics, implement a wholly new military application for technology, or define a new means by which to wage war are all considered "transformational." This includes the numerous instances where the U.S. military simply emulated another military. All other changes are labeled "incremental." At the strategic level, a *product champion* existed in all but one change example (See Table 4). However, in four of the changes, *civilian intervention* was required in addition to the *product champion* to bring about change. In the cases of the OSS and long-range escort fighters, an outside civilian actually brought the idea to an individual on the inside, who championed it within the organization. For the OSS, President Roosevelt felt the need for better intelligence on which to base his decisions, and was the only person with enough authority to create an agency (the COI) to oversee the work of the four intelligence agencies of the time. However, William Donovan's vision made the OSS into the high-impact organization it would become. Donovan also suggested the OSS report directly to the Joint Chiefs of Staff.

During the long struggle for a suitable long-range escort fighter, the AAF was aware of the problems daylight precision bombing presented for bomber crews and of the magnitude of the losses occurring, but it took a civilian from outside the organization to offer a better solution. Had Assistant Secretary of War Lovett not written his memorandum recommending longer-range escort fighters as the solution to AAF Chief General Arnold, it is unlikely the institution would have been so quick to field the P-51. However, once the problem and solution were clearly defined by Lovett, General Arnold became the "champion" of the idea, ordering it into existence and subsequently accelerating deliveries of the P-51 to England. Both were necessary to bring about change in this area.

	Product Champion	Civilian Intervention
Daylight Precision Bombing	X	
OSS	X	X
Marine Raiders	X	X
Long-Range Escort Fighters	X	X
OSRD	X	X[1]
Mounted Cavalry[2]		
Airborne Divisions	X	
Air Commandos	X	

[1]OSRD, though working primarily on military problems and employing numerous military personnel, was technically a civilian-run organization; it fell under the direction of the White House.

[2]Horse-mounted cavalry was abandoned without a clear case of either condition

Table 4. World War II Strategic-Level Changes.

The one instance of change where neither a product champion nor civilian intervention was present—mounted cavalry—was a clear case of abandonment. Mounted cavalry was demonstrated to be highly vulnerable on the armor-rich World War II battlefields by the Polish in 1939. The successful use of the horse by Russian Cossacks against German combined-arms forces on the Eastern Front was either not widely publicized at the time, came too late for the U.S. Army to reverse course, or appeared anomalous to those deciding the best ways to fight. Though there were debates and objections about the future of the cavalry, there was no intervention to preclude the shift to the motorized configuration.

In sum, the existence of a *product champion* was slightly more important in bringing about a significant change that *civilian intervention.* However, four changes required the existence of both: the creation of the Marine Raiders, the OSS, the OSRD, and the long-range escort fighter. In the instances of the OSS and the OSRD, the existence of both a product champion and civilian intervention is explained by the fact

that both organizations were originally constructed outside the military chain of command. The OSRD actually reported to the White House, though later on a portion of it was transferred over to the U.S. Navy to carry out ASW. The OSS was the brainchild of a civilian product champion, who convinced the President of the merit of his ideas, who agreed to create it place it under the control of the Joint Chiefs of Staff. It appears there must be strong advocacy on both sides of the civil-military divide for successful organizational transfers to take place.

The creation of the Marine Raiders, however, involved no such transfer. Instead, the product champions within the military establishment at first tried unsuccessfully to bring about change to their service and subsequently appealed to the president, who happened to be an acquaintance. This is clearly a unique set of circumstances, but indicates that if a military product champion can persuade the civilian leadership—bypassing his chain of command—the chances are in his favor of getting the change implemented.

The changes initiated at the operational level—where campaigns and major operations are managed—were few. This is no doubt due to the nature of the operational level of warfare itself; commanders at the operational level focus on the implementation of the strategy laid down for them by higher. In doing so, they rely on the capabilities of those units and commanders at the tactical level. When there is a need for a new or increased operational capability, it must be provided by improvement or changes at the tactical level. In World War II, these capabilities largely emerged as a result of the iterative nature of the conflict. Battle after battle, soldiers, sailors, and airmen assessed their effectiveness and made adjustments to reduce casualties the next time around. Therefore, the *emergent* hypothesis holds the greater explanatory power at the operational level.

For example, the ASW doctrine *in use* (as opposed to that *in publication*) changed numerous times and eventually provided the operational commanders, Admiral King (CINCUSFLEET) and his counterpart in charge of Britain's Coastal Command the necessary capability to defeat the U-boat threat to merchant shipping. No central individual or group sat down to re-write ASW doctrine during the Battle of the Atlantic.

Instead, multiple incremental improvement to tactics, equipment, and organization were put forth by ASWORG (later, the U.S. Navy's Tenth Fleet) and implemented. Those that worked remained, and those that did not provided more data points for the analysts.

The doctrine in use at the turning point in the Battle of the Atlantic (effectively May, 1943, when German Admiral Doenitz pulled his U-boats out of the North Atlantic convoy routes) was a hodgepodge mixture of escorts, medium bombers, RADAR, code-breakers, centralized command, and other tactical improvements. It *emerged* over time. Following the termination of the war, lessons would be distilled and the applicable principles would be pulled out to form the basis for post-war ASW doctrine publications.

In contrast, the organization created (also by a reluctant Admiral King) in response to the excessive shipping losses, the ASWORG, was the result of a member of his staff who had a clear vision about what such an organization could bring to bear on the problem. In this instance of change, the organization—albeit a lone "champion"—understood the nature of the deficiency, and when he did not have a solution of his own, he proposed an emulation of those who did (the British).

In each instance of doctrinal change (ASW, carriers, amphibious operations, and combined-arms), the emergent doctrine provided the operational commander an improved capability with which to plan for and wage major operations. Certainly, Operation Overlord could not have been planned or even seriously considered without the previous amphibious experiences and subsequent adjustments, such as those made following Guadalcanal, Tarawa, Iwo Jima, and the British defeat at Dieppe to name a few.

	Planned	Emergent
Amphibious Operations Doctrine		X
ASW Doctrine		X
ASWORG	X	
Carrier Doctrine		X
Combined Arms Doctrine		X

Table 5. World War II Operational-Level Changes

The tactical level—the level at which it is decided *how battles are fought*—is by definition diffuse, and therefore a difficult level about which to make generalizations. Nevertheless, the changes examined in this case indicate that it is likely an external event, such as the experience of defeat or higher-than-expected casualties during an operation, is still required to enable change, even if a decentralized command structure exists. While decentralization alone may be sufficient, it was not in any of the changes examined here. It should also be evident that only three instances of tactical-level changes were part of this portion of the study.

The lone change that did not require either decentralization or a previous failure was the implementation of airborne operations doctrine. This is not to say there were no failures during the course of airborne doctrine maturation; there most certainly were. The adoption of airborne operations and forces was due to the perception of German success, which suggests that perceived successes could also bring about change.

Once it existed, American airborne doctrine was centrally managed by its proponents. Also, though never assessed as complete failures and never experiencing higher-than-anticipated casualties, early airborne operations did in fact experience numerous problems. The development of airborne doctrine also follows the trial-error-correction pattern. During the Allied invasion of Sicily, airborne forces were the main effort. The results of that event helped shape subsequent airborne operations as tactical tools for use in support of operational capabilities. The airborne would remain a tactical tool until the end of the war.

	Decentralization	Excessive Casualties or Mission Failure
Hedgerow Combat Modifications	X	X[1]
Airborne Doctrine		
Nighttime, Low-Level Incendiary Bombing	X	X[1]
[1]Mission Failure		

Table 6. World War II Tactical-Level Changes

The previous three discussions have corresponded to the level at which a change was initiated. With respect to technological changes, a level of warfare assignment would be inappropriate. It would be easy enough to aggregate these changes in with the strategic-level, as most technological advances must be vetted at least through the top echelon of the service into which they are to be implemented. However, that approach obscures the true origin of the change. As such, the technological changes are presented in a separate table (See Table 7.)

The most prominent aspect of the technological changes included in this study is the fact that there was actually a stated need for the new technology in the theater of war. This does not mean that the changes implemented to fill the need were effective—not all of them were. In particular, the procurement of SONAR in anticipation of the U-boat threat proved to be ineffective. In addition, the Norden bombsight, though over ten years old at the time, was fielded on as many bombers as possible before any American bombers flew combat missions. Though its performance was poor, accurate assessment of bombing missions was extremely difficult; it was assumed the sight worked. Furthermore, its high security classification prevented pre-war testing, and the mystique of the sight overshadowed the reality of its poor performance.

It is no coincidence, then, that those two technological changes were also the ones procured by the War and Navy Departments in response to German aggression in Europe, but before the U.S. officially entered the war or experienced combat of any sort. Another change that needs explanation is the emulation of Germany that led to the implementation of the parachute and glider. While the U.S. had previously experimented with the parachute, neither it nor the glider was considered militarily useful until the Germans showed the world what could be done with airborne forces starting in 1940. The War Department misunderstood the difficult nature of Germany's invasion of Crete, and ordered the initiation of the airborne program solely based on its perception of a discrepancy between the capabilities of the German and American militaries.

Nevertheless, the *combat need* hypothesis holds far greater explanatory power for technological changes implemented during World War II.

	Combat Need	Procurement Inertia
SONAR	X	X
HF/DF Systems	X	
S-Band RADAR	X	
Norden Bombsight	X	X
Parachute / Glider	X	
Unmanned Bombers	X	
Bazooka	X[1]	
Specialized Landing Craft	X	

[1] Though no specific evidence was found of a formal, written requirement, it is inferred that the army laboratories knew of the infantry's need for an organic anti-armor weapon

Table 7. World War II Technological Changes

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III. VIETNAM

A. INTRODUCTION

Study of the American experience in Vietnam allows an incisive look at how the U.S. military both changed itself and handled changes imposed by political constraints. Instances of change were numerous. The sheer length of the conflict certainly increased the number and types of changes undertaken by the military. Duration was not the only contributing factor; the nature of the enemy and his ability to frustrate the American military in battle also proved powerful catalysts for change.

B. BACKGROUND

As the Vietnam War has been described as essentially not one, but two wars, it therefore can be considered to have not one, but rather two beginnings. American involvement in South Vietnam began as an advisory mission during the 1950s. As Communism spread throughout Southeast Asia, numerous possible military actions were planned and debated to contain it.

Many in the U.S. Government—President Kennedy chief among them—recognized a fundamental difference in the nature of the struggle occurring in Indochina and that for which the American Military was structured at the time. Thus, President Kennedy's directive to Secretary of Defense McNamara to increase the Department of Defense's capability to wage counterinsurgency marks the beginning of the preparatory phase for what was seen as an increasingly likely military intervention in Southeast Asia.

The initiation of the counterinsurgency effort—implemented primarily by small numbers of Special Forces—occurred in 1961, and therefore marks the beginning direct U.S. participation in the "irregular" war in Vietnam (Ives, 2007). The other, "bigger," conventional war effectively began with the passing of the Gulf of Tonkin Resolution on August 7, 1964, which gave the president the authority to

> take all necessary steps, including the use of armed force, to assist any member or protocol stat of the Southeast Asia Collective Defense Treaty requesting assistance in defense of its freedom...” until the President determines “…the peace and security of the area is reasonably assured by international conditions created by action of the United Nations or otherwise… [unless] terminated earlier by concurrent resolution of the Congress. (Porter, 1979)

World War II was conducted, at least at its height, as a *total war*. Vietnam was a *limited war* in nearly every aspect. American resources, methods, popular support, and even purpose were limited, which in turn shaped the nature of changes that occurred (Komer, 1986). Self-imposed restrictions, such as the “defensive-only” rule governing attacks on Soviet-supplied surface-to-air missiles (SAMs) created the need to work around difficulties that should have been eliminated up front, and resulted in doctrine for countering threats locally instead of pre-emptively destroying them.

C. SPECIFIC CHANGE EXAMPLES

<table>
<tr><th></th><th>Sea</th><th>Land-Sea</th><th>Land</th><th>Air-Land</th><th>Air</th><th>Sea-Air</th></tr>
<tr><td>Organization</td><td>Task Force 115 (Coastal Surveillance Force)</td><td>SEALs

Task Force 117 (Mobile River Force)</td><td>Civilian Irregular Defense Group (CIDG)

Combined Action Platoons (CAPs)</td><td>Airmobile Cavalry Division</td><td>4400 Combat Crew Training Squadron</td><td>Task Force 116 (River Patrol Force)</td></tr>
<tr><td rowspan="2">Doctrine</td><td rowspan="2">“Brown-Water” Naval Doctrine</td><td></td><td>“Search and Destroy”

“Large Unit” Operations

“Pacification”</td><td>Herbicidal Warfare

Vertical Envelopment</td><td rowspan="2">B-52 Conventional Bombing

Suppression of Enemy Air Defense (SEAD)</td><td rowspan="2">Aerial Mining</td></tr>
<tr><td colspan="3">Marine Amphibious Raiding (ARG/SLF)

Task Force 194 (SEALORDS)</td></tr>
<tr><td>Technology</td><td>Riverine Craft (PBRs, etc.)</td><td>Advanced Tactical Support Bases (ATSB)</td><td>M16

M113 ACAV</td><td>Helicopters</td><td>Laser-Guided Bombs
Fixed-wing Gunships</td><td></td></tr>
</table>

Table 8. Selected Changes for the Vietnam War

1. “Large Unit” Operations

The decision to send large numbers of conventional troops was, in retrospect, the most important change of the war. Prior to 1965, the U.S. supported South Vietnamese forces engaged in counterinsurgency, but growing impatience within both the Joint Chiefs of Staff and the white house with what was perceived as South Vietnamese incompetence created an environment ready for change. The only question was what type of approach the U.S. should adopt (Krepinevich, 1986).

Despite several studies and wargames indicating the truly difficult nature of jungle counterinsurgency and the poor results American combat troops could be expected to achieve, General Westmoreland, commander of U.S. Military Assistance Command, Vietnam (USMACV) advocated privately to President Johnson that large numbers of combat troops were needed. Johnson, for his part had favored that type of an approach all along, and despite the studies and wargames, the Joint Chiefs of Staff agreed with him. The only dissenting voice was that of the U.S. Ambassador to South Vietnam (and retired Army General Officer) Maxwell Taylor, who advocated expanding the U.S. Marines’ approach to “pacification” through spreading security to the population outward from the cities and hamlets. Ultimately, his dissension proved no match for the combined forces of President Johnson, General Westmoreland, and several members of the Joint Chiefs of Staff, who thought large-scale American military action was the means by which to rid South Vietnam of its communists (Krepinevich, 1986).

2. The M16 rifle

The rifle in service at the time of wide-scale American involvement in the Vietnam War was the M14. The Army did not necessarily believe that it needed a new rifle. In fact, it had just spent 15 years developing the M14. Yet in 1967, the U.S. Army decided to replace its entire inventory of M14 rifles with the M16. The process, on the surface, appears a deceptively simple case of “product champion” in that the Chief of Staff of the Army, General Harold K. Johnson, effectively made the decision following a study he initiated comparing the XM16E and the “Special Purpose Individual Weapon” (SPIW) prototypes. It was more complicated than that (McNaugher, 1984).

It was Secretary of Defense Robert McNamara, who in 1962 asked why the Army was buying more M14s when a “better” weapon (the Armalite AR-15) was available. McNamara had been made aware of the AR-15 not only through Colt firearms representatives (who were partnered with Armalite), but also Chief of Staff of the Air Force, General Curtis LeMay, who was interested in equipping USAF security police with the new rifle. McNamara, for his part, had brought a somewhat iconoclastic method to the Office of the Secretary of Defense (OSD), favoring analytical studies over tradition in many cases. He wanted the Army to take a hard look at the AR-15 (McNaugher, 1984).

From the Army’s perspective, the AR-15 represented much more than a change in rifle. It represented a wholesale shift away from the tradition of marksmanship on which it had built a long tradition. The AR-15 was light, fired a smaller caliber round, and looked more like a toy weapon than the M14 or its predecessor, the vaunted M1 Carbine. Army traditionalists wanted nothing to do with a “toy” rifle, but the Secretary of Defense pressed them until they agreed to purchase small quantities and equip select units with them (McNaugher, 1984).

By late 1964, the Viet Cong had begun receiving substantial quantities of the AK-47, the highly reliable Soviet-made automatic rifle. Its shorter range and lesser accuracy (compared to the M14) was unimportant in the jungle, where its superior volume of fire made General Westmoreland come to believe that the AK-47 gave the enemy a significant advantage. As it would happen, those units designated to receive the AR-15 (now designated the M16) were some of the first to be sent to South Vietnam. Units like the 82nd Airborne, the 101st Airborne, and the Special Forces all carried the M16 into combat in 1965. Noting the weapon’s popularity among the units employing it, Westmoreland asked the Department of the Army to investigate the cost and logistics implications of delivering more M16s to Vietnam. At that point, he still considered the weapon as insufficiently combat-tested, and opposed full-scale integration until it was proved otherwise. The battle of Plei Me changed his mind. Following the conclusion of the battle, he was informed by one of the commanders involved that “Brave soldiers and

the M16 rifle brought this victory." Within two months, Westmoreland had requested more than 293,000 M16 rifles with which to equip both American and Vietnamese forces (McNaugher, 1984).

Though he initially wanted the Army to procure the new weapon three years earlier, McNamara did not want the M16 issued to South Vietnamese troops for fear it would end up in the hands of the Vietcong. He changed his position on the weapon, and instead backed the Department of the Army, which still officially opposed full-scale integration of the M16 and was completing its Small Arms Weapon System (SAWS) study. No doubt, the Chief of Staff of the Army, General Johnson, felt the pressure to support the combatant commander and his troops. Johnson traveled to Aberdeen Proving Grounds, fired some of the SPIW prototypes, and unilaterally decided they were simply too complex; in December 1966, he wrote to Secretary McNamara that for the foreseeable future, the Army would be pursuing only the XM16E1 (the prototype M16) (McNaugher, 1984). The immediately available weapon—and by default, the theory of volume fire—won out over the M14 and the era of marksmanship.

3. "Pacification"

"Pacification" became simply a different approach to the war. U.S. Army Chief of Staff, General Harold K. Johnson sponsored a study in 1967 titled "A Program for the Pacification and Long-Term Development of Vietnam"—better known as PROVN—in an effort to repudiate the approach used by General William Westmoreland for the previous two years. The authors of the PROVN study contended that the security of the South Vietnamese population was the critical measure of success—not the "body count" in use at the time (Sorley, 1999).

Clearly, the Commander, U.S. Military Assistance Command, Vietnam (MACV), General Westmoreland, could embrace neither the PROVN study results nor the concept of Pacification as a theory of victory without publicly admitting his own ideas and war strategy were fundamentally flawed (Sorley, 1999). Therefore, the concept of Pacification would be shelved until an amenable proponent would arrive in a position of authority to put it into practice.

Such a leader arrived in May 1967, when General Creighton Abrams took the position of Deputy Commander, USMACV. He was initially slated to succeed General Westmoreland just a few weeks following his arrival, but instead did not ascend to command for nearly a year thereafter. The reason for General Westmoreland's retention was that following a visit to Vietnam during the same time period as General Abrams arrival, Secretary of Defense McNamara remarked to the press that instead of asking for yet more troops, as Westmoreland had recently done, he should more effectively use the forces he already had in theater (Sorley, 1999). A subsequent public reparation of feelings between the Johnson administration and the U.S. Army followed. In terms of the war, President Johnson could not remove Westmoreland without publicly acknowledging he had made a mistake in personally selecting him for the position in the first place.

General Abrams took command of MACV in June 1968. Though the PROVN study had been written earlier by multiple staff personnel, and many flag-rank officers believed General Westmoreland's (and therefore President Johnson's) concept of how the war should be conducted was thoroughly defunct, it took the ascension of General Abrams to the position of commander to institute the changes required of the Pacification doctrine.

4. U.S. Navy Sea, Air, Land (SEAL) Teams

In March 1961, the Navy's Strategic Plans Division proposed the formation of sea, air, land teams—to be known by the acronym SEAL—whose responsibilities would include the development of guerrilla/counter guerrilla capabilities. This proposal was made in response to the perception of President Kennedy's advocacy for the U.S. Army's Green Berets. Later, the proposition was expanded to add the duties of doctrinal and tactical development, and an advisory function. The units were to be manned from existing underwater demolition team (UDT) units (Bosiljevac, 1990).

The creation of the SEALs represents an adaptation of an existing force to emulate the capability of another service. It is noteworthy that the core capabilities of the UDT men were retained, but their mission and operating domain expanded (from "sea" to "sea, air, and land") to meet the needs of the anticipated operational environment. Their

initial deployment to South Vietnam was, like their Army and Air Force counterparts, advisory in nature until they found themselves fighting alongside their "advisees" against Viet Cong infiltrators.

5. Brown-Water Doctrine

Though numerous examples of littoral operations exist throughout its distinguished history, the doctrine of the U.S. Navy in 1962 focused primarily on deep or "blue water" operations. However, the Navy made a concerted effort to assess the possible roles and missions it could take on in support of the counterinsurgency mission. As was the case with the other services, the Navy found its personnel transitioning from advisory roles to active war planning to direct combat missions by 1965. The Navy had no up-to-date, published doctrinal guidance for the operations it began to undertake in support of USMACV—that mission had been traditionally filled by Marines, in particular the Amphibious Ready Group (ARG) and the Special Landing Force (SLF) (Marolda, 1994).

Naval planners also had the benefit of studying the French riverine force, the *Dinaussaults*, who used heavily armored and armed flotillas to conduct operations between 1946 and 1954, and their Vietnamese counterparts, the river assault groups (Fulton, 1973). Through the implementation of coastal and riverine patrols, and the combined operations with the army, the Navy had effectively figured out how to modify and use the small craft of the era to their utmost capabilities in support of both the counterinsurgency and large-scale conventional military operations. The Navy codified this doctrine in October 1968, when it published Naval Warfare Pamphlet (NWP) 21(A) *Doctrine for Riverine Operations*, effectively recording the best fundamentals it had learned regarding its two key missions in Vietnam: riverine assault operations and waterway interdiction and surveillance operations. A second volume—NWP 21(B)—was drafted in 1971, which emphasized patrol and barrier interdiction procedures (Marolda, 1994).

6. Coastal Surveillance Force (Task Force 115)

In response to a mounting belief that Viet Cong personnel, arms, and heavy equipment were being infiltrated into the South from the sea, the Commander in Chief, Pacific theater (CINCPAC) ordered a nine-man team to study the problem. The results of the study—named the Bucklew Report after its primary author, Captain Phillip H. Bucklew, a highly decorated UDT officer—were briefed in February, 1964. They included the assessment that though the movement of personnel was largely being accomplished overland, the Mekong and Bassac River complex provided a "natural and easily penetrable waterway" on which to transport heavy matériel. It further stated that seagoing "junks" and fishing boats could be used to infiltrate Viet Cong agents into the northern area of the Republic of Vietnam (Cutler, 1988).

Though the Bucklew Report pointed out numerous actions that could be taken to stem the flow into the Republic of Vietnam from the waterways, no actions were taken at the time. The decision to take military action on the waterways was made following a chance observation by a U.S. Army UH-1 pilot in March 1965. He observed what appeared to be a *moving* tree-covered island in the middle of a waterway. Upon closer inspection, he determined the "island" to be a camouflaged ship, and radioed his observations to the appropriate Coastal Zone controller. Over the next several days, airstrikes and assaults were carried out, resulting in a capsized "island" and the discovery of millions of rounds of small arms ammunition and thousands of grenades, mortars, rifles, and machine guns. The next day, COMUSMACV requested theater naval personnel travel to his headquarters to plan a counter-infiltration effort (Cutler, 1988).

The resulting organization, titled Task Force 115, and also known as the Coastal Surveillance Force, implemented most of the recommendations from the Bucklew Report and was initially comprised solely of existing "blue water" naval assets drawn from the existing Task Force 71 (Cutler, 1988). It would soon expand to include long-range patrol aircraft, destroyer escorts, patrol gunboats, minesweepers, "Swift" patrol boats, and Coast Guard cutters (Riverine warfare, 2006).

7. River Patrol Force (Task Force 116)

In March 1966, another recommendation of the Bucklew Report came to fruition as Task Force 116 began patrolling the rivers environment of the Mekong Delta using primarily River Patrol Boats (PBR) and UH-1B "Seawolf" helicopters. The River Patrol Force effectively extended Task Force 115's reach and degraded the Viet Cong's ability to move matériel inland. In 1969, Task Force 116 began using OV-10 "Bronco" aircraft to increase its firepower and search capabilities (Dunnavent, 2003).

8. Mobile River Force (Task Force 117)

Though Task Forces 115 and 116 were effective at accomplishing their respective missions, General Westmoreland and the Commander, Naval Forces Vietnam (COMNAVFORV), Rear Admiral Kenneth L. Veth, desired a force that could not only use the rivers as a means to approach and harass the enemy, but also go ashore, encircle, and engage an enemy force. As they were heavily engaged in other regions, no U.S. Marine units were available to form the ground component of the new task force—Task Force 117 (Dunnavent, 2003).

Instead, the U.S. Army's Second Brigade, Ninth Infantry Division was slated to fill the task force's need, and underwent specialized training in the upper San Francisco Bay before deploying to Vietnam in mid-1967. The task force would be the first joint Army-Navy unit of its kind, and also became known as the Mobile Riverine Force (MRF) (Dunnavent, 2003; Riverine warfare, 2006).

The MRF marked a significant change in concept from the previous task forces. Ground troops lived aboard 11 barracks ships which made up "Mobile Riverine Bases," anchored in the Mekong River delta. The remainder of the 186-boat force was composed of numerous riverine assault craft and several types of converted vessels. Among them were artillery barges, armored troop carriers (ATCs), and "Monitors"—"Landing Craft, Mechanized" LCM-6 modified for the fire support mission with the addition of .30 caliber, .50 caliber, and 20mm machine guns, grenade launchers, 81mm mortars, and either a 40mm or 105mm cannon (Riverine warfare, 2006). Handfuls of LCM-6 landing craft were further modified to employ twin flamethrowers and became known as

"Zippos." Zippos could effectively engage targets 160 meters away and, due to heavy foliage along the riverbanks, at times were the only weapons effective against enemy bunkers (Friedman, 1987).

Eventually, TF 117 exhausted the limits of what could be achieved through riverine craft landings against a responsive Viet Cong. The MRF added an air mobility component to its operations, using helicopters to carry troops into battle, command and control, and also for resupply. During offensive operations, heli-borne infantry covered a main assault force's flanks, and helicopter gunships were used for fire support (Fulton, 1973).

9. Task Force 194

Combined, TF 115 sought to blockade the south from infiltration, TF 116 hindered Viet Cong concealed movement on the inland waterways, and TF 117 sought out and engaged the enemy ashore. In the wake of the Tet offensive, the new COMUSMACV, General Creighton Abrams, urged the commander, NAVFORV, Vice Admiral Elmo Zumwalt to take more aggressive actions to stem the inflow of fighters from North Vietnam (Dunnavent, 2003). The enemy had changed his strategy and had begun to move in much smaller groups, using the smaller waterways and canals to avoid detection. NAVFORV had not adjusted it concept of operations, and it was apparent that infiltration from the north was still a major problem.

Admiral Zumwalt toured the extent of the naval operations in the theater and came to the realization he could effectively blockade by water the majority of the Mekong Delta region, to include the area surrounding Saigon. His idea became known as the Southeast Asia, Lake, Ocean, River, Delta Strategy—SEALORDS. Initiated in October 1968, Zumwalt pulled together the existing riverine task forces: 115, 116, and 117, and combined them into a single entity, Task Force 194 (Dunnavent, 2003).

10. Amphibious Ready Group (ARG) and Special Landing Force (SLF)

The force one would normally associate with amphibious operations—the U.S. Marines—was heavily employed during the early years of the conflict, but were initially

assigned to the mission of securing the airfields, villages, and cities in South Vietnam. The Seventh Fleet Special Landing Force was essentially a rotating force-in-being capable of crisis response missions throughout the theater. The deployment of Marines to Vietnam so over-tasked the U.S. Navy's Seventh Fleet that the SLF's dedicated transportation, the Amphibious Ready Group was needed to transport the Third Marine Amphibious Brigade to the shores at Chu Lai in early 1965. As a result, the SLF was temporarily disbanded (Shulimson & Johnson, 1978).

Though Marines had already conducted amphibious landings, many times they were to beaches that were already under friendly control located within another unit's area of responsibility. As more shipping became available in the spring of 1965, planners at USMACV and headquarters, Seventh Fleet, proposed the concept of using amphibious raiding forces to interdict enemy infiltration and marshalling points along the coast to supplement the activities of the Coastal Surveillance Force (TF 115). On March 14, 1965, General Westmoreland and Admiral Johnson, COMNAVFORV, agreed to the staffs' proposal to develop a concept of operations for a combined U.S. and South Vietnamese Marine amphibious force (Shulimson & Johnson, 1978).

Soon thereafter, the SLF was reactivated and became the primary raiding force, though the air and ground units of which it was composed continued to rotate through the duty as they did previously. Eventually, the South Vietnamese Marines proved that complex amphibious operations were beyond their capabilities, and the concept was pared to include only American Marines. Additionally, numerous squabbles about the organization and command relationship of the SLF, ARG, task forces, and MACV hindered efforts to plan and execute missions. By June, General Westmoreland openly wondered what had happened to the amphibious raiding concept he had agreed to back in March (Shulimson & Johnson, 1978).

In late September, the SLF executed its first raid via amphibious craft and helicopter landing. While the force secured its objective and demonstrated the new command relationships and existing doctrine to be reasonably sound, few enemy were found. A series of several more raids were executed in similar fashion under the operational label Dagger Thrust. Marine Corps official history assesses the Dagger Thrust

raids as having "failed to achieve their overall objective, the quick exploitation of intelligence and resulting contact with large enemy formations," largely due to the excessive coordination required to plan and execute, which resulted many times in stale intelligence (Shulimson & Johnson, 1978).

SLF raids continued throughout the next year, but would never achieve the results the originators of the idea had hoped for. Additionally, General Westmoreland grew increasingly uncomfortable with his inability to influence the SLF's operations and eventually required Seventh Fleet to rearrange the command structure to assure him greater influence. Though the SLF continued to carry out operations into 1967, its results never proved worth the immense effort required to execute the raids, which resulted in significant numbers of American casualties. Eventually, it became a de facto reserve force, augmenting Army and other Marine operations as necessary. As one Marine colonel involved in sorting out the difficulties of the Navy-Marine-Army command relationship would later put it, SLF operations in Vietnam "by and large were sort of contrived. It was almost a concept looking for a home" (Shulimson, 1982).

11. Civilian Irregular Defense Group (CIDG)

The CIDG concept was developed to provide an organized defense capability for those villages that for various reasons could not be defended by the Army of the Republic of Vietnam (ARVN) and did not fall under the government of Vietnam's control. Their ancillary missions included border security patrols, intelligence gathering, civic action programs, and psychological operations (Jervell, 1967).

In practice, the CIDG was initially sponsored by the Central Intelligence Agency. However, the acknowledged first "experiment" carried out in highland Montagnard village of Buon Enao occurred in 1961, and was executed by two Americans: one a Special Forces medic and the other an International Volunteer Services (IVS) official working out of the U.S. Embassy in an agricultural improvement capacity (Ives, 2007). The trust gained through improvement of the villagers' health needs enabled further pledges on the part of the Montagnards to secure their own villages from incursion by the Viet Cong. Following the success at Buon Enao, more Special Forces were "loaned" to

the CIA and sent into the highlands. By 1963, the Special Forces ran several similar programs that together became the CIDG, and had effectively mobilized more than 30,000 indigenous personnel who not only maintained their own village security but also patrolled the surrounding jungle and prevented the VC from moving into the region (Ives, 2007).

One of the keys to the initial success of the CIDG construct was the sheer uniqueness of it—particularly the logistical support provided by the agencies involved. The Special Forces were able to procure equipment for the irregular forces without having to request it through military supply. However, with growth came a fundamental shift in the focus of activities. In mid-1962, the Special Forces contingent operating in the highlands was large enough that it required the establishment of U.S. Army Special Forces (Provisional), Vietnam, commanded by a colonel.

Growth also brought with it a shift in focus from internal village security to the development of strike forces, whose missions included patrolling the border with North Vietnam. It also meant the still relatively small SF contingent could not directly manage the large numbers of irregular forces created. Therefore, it became necessary to turn over the responsibility for individual villages to the South Vietnamese Special Forces for continued support. Unfortunately, the Montagnards and the South Vietnamese Government had long-standing animosities that prevented an effective working relationship (Kelly, 1973). The initial successes began to fade in 1964, and by the time large numbers of combat troops were committed in 1965, American strategic focus had shifted elsewhere.

12. Combined Action Platoons (CAPs)

The initial deployment of American Marines to South Vietnam in 1965 was intended to improve the security of Da Nang airbase and the immediate vicinity (History and Museums Division, U.S. Marine Corps, 1974). Their task soon expanded to include several cities and the numerous surrounding villages in the I Corps area of operations. As the Marines had a history of conducting “small wars,” the initial approach to security

taken by General Lewis Walt, Commander of Marine Forces under USMACV stressed building a relationship of trust with the local population.

One of the company commanders, frustrated at being unable to sort enemy from neutral in a village for which his company was responsible, took the concept one step further. Instead of relying solely on increased patrols, he permanently deployed his Marines within the village to send the message to the residents that they would be secure. His motive was purely pragmatic—he simply did not have enough men to patrol enough to provide the level of security required to keep the VC from returning to that village (Krepinevich, 1986). In essence, the lack of resources to do otherwise forced a creative solution.

Additionally, he took the local paramilitary "Popular Force" unit under his command, and soon the villagers were made increasingly responsible for their own security. Eventually, combined patrols were conducted around the clock—something he could never have accomplished using just his own company. Word of the success in driving out VC spread quickly, and soon the concept was replicated in numerous nearby villages (Krepinevich, 1986).

CAPs would remain a local success, however. Though the program was formalized by the Marines and eventually secured over 800 villages, General Westmoreland and several of his staff viewed the entire endeavor as a waste of combat power—forces that could be out searching for and destroying the enemy in the jungles instead sat around the villages and "didn't do anything" (Krepinevich, 1986). And though the program was successful in I Corps, there is no guarantee the idea would have been a "war winner" on its own (Kopets, 2002).

13. Search-and-Destroy

Following the passage of the Gulf of Tonkin resolution in the fall of 1964, MACV began requesting and receiving an ever-expanding number of forces and equipment. By early 1965, serious debate about how best to use American ground troops was occurring, and could be divided into three distinct schools of thought: (1) base security—protecting U.S. airbases from which airstrikes against the north were to be carried out; (2) an

enclave strategy, where American forces would be used to deny key geographical regions in the South, while ARVN forces conduct offensive operations against the VC; and (3) a search-and-destroy, by which American forces would "seize the initiative" (Komer, 1986).

General Westmoreland, COMUSMACV, favored the third option, which was effectively sanctioned by President Johnson through National Security Action Memorandum 328, dated April 6, 1965 (Komer, 1986; Porter, 1979). Though unconventional and irregular operations were still part of the overall strategy, they took a back seat to what would become the massive effort to seek out and destroy VC "main units."

14. M113 Armored Cavalry Assault Vehicle (ACAV)

Though much debate occurred about whether or not armored vehicles could perform any sort of role in the jungles of Vietnam, M113 armored personnel carriers (APCs) were transferred to the South Vietnamese to replace the old French armored vehicles in use at the time. The M113 was designed specifically to transport infantry *to* an engagement while affording protection from hostile fire. American doctrine dictated that upon reaching the objective, the infantrymen dismounted and attacked on foot. American advisors had great difficulty convincing their Vietnamese counterparts to dismount; instead, they preferred to attack the enemy using the vehicles' mounted weapon and their individual weapons from the open hatches (Starry, 1979).

During the battle of Ap Bac in January 1963, the Vietnamese Second Armored Cavalry Regiment attempted to reach an American helicopter that had crashed bringing in a reserve force of Vietnamese infantry soldiers. The Viet Cong had enough advance warning of the operation that they prepared defensive positions. During the course of the engagement, the main vulnerability of the M113 mounted-infantry assault tactic became apparent as fourteen soldiers operating the top-mounted (and largely exposed) .50 cal. machine guns were killed (Starry, 1979).

The result was a Vietnamese initiative to add an armored shield around the gunner's position, which they did using any available scrap metal that could be found.

They modified the first few M113s using soft steel from the hull of a sunken ship. When that was discovered to be penetrable, a larger search effort yielded armor plating from salvaged armored vehicles. Additionally, side-mounted machine guns were added to increase firepower available from atop and within the vehicle. All Vietnamese M113s were modified by 1964 (Dunstan, 1982; Starry, 1979).

The relative effectiveness of mounted-infantry assaults over dismounted ones did not dissuade MACV advisors from attempting to persuade the Vietnamese armored cavalry troops to employ the M113 "correctly" by dismounting from it once in contact with the enemy. The idea never caught on. In fact, quite the opposite occurred: when the 11th Armored Cavalry Regiment was preparing for deployment to Vietnam in 1966, it elected to leave its tanks behind, replacing them with M113s that had been modified with additional hatch armor and two M60 machine guns—one per side. This modification—known as the ACAV—eventually became the standard American M113 configuration in Vietnam (Dunstan, 1982).

15. Vertical Envelopment (Airmobile)

The first air assault of the Vietnam War took place in December 1961, when American helicopter crews—having just arrived in-country eleven days prior—airlifted approximately 1,000 Vietnamese paratroops to a suspected Viet Cong headquarters complex located ten miles west of Saigon. Resistance during the operation was reportedly "slight," from the surprised enemy (Tolson, 1973).

However, the concept of heli-borne, airmobile troops was not new at the time. The Army had been involved with the concept at some level or another since the Korean war (primarily in the medical evacuation, or "medevac" mission), but the limitations of the available helicopters to perform the mission of transporting troops on a large scale kept the Army from widescale adoption. The Marines had also previously demonstrated that small numbers of troops could be transported by helicopter to overcome the difficulties of the Korean terrain (Tolson, 1973). The ideas were there, but the technology still lagged far behind.

At the urging of Secretary of Defense McNamara, the U.S. Army initiated a review of its mobility requirements and capabilities shortly after he took office. McNamara took interest in the Army's plan for its helicopters because he believed in the transformational nature of the helicopter—a view at least partly formed by inputs from the aviation industry—but also as a response to the lack of vision in the Army's existing plan (Horwood, 2006). The subsequent study, known as the Howze Board (after its chairman, General Hamilton H. Howze, former Director of Army Aviation) included eight major exercises designed to represent several different geographic regions and tactical scenarios. More than one was designed to assess the effectiveness of the helicopter in support of counterinsurgent operations in remote, mountainous terrain.

Additionally, a team of representatives from the board traveled to Vietnam in June 1962. The published report concluded that the helicopter would provide solutions to some of the tactical and logistical difficulties Vietnam presented, enjoying advantages in mobility and firepower over conventional units. It recommended the formation and deployment of three air assault divisions there, and ultimately the conversion of five of the army's 16 divisions to air assault divisions (Horwood, 2006).

One month after Howze made his recommendations, the Army deployed fifteen UH-1s to Vietnam along with a team to evaluate their effectiveness in counterinsurgency (Dougherty, 1999). The evaluation of these first helicopters focused primarily on their ability to support troop transport operations with armed escort. By 1964, there was one Army aviation company or Marine aviation squadron per Vietnamese Army Division (Tolson, 1973). The newly formed First Cavalry Division (Airmobile) was one of the first units to be deployed to Vietnam during the troop buildup beginning in early 1965 (Allen, 1993).

By 1966, the airmobile concept extended far beyond the First Cavalry Division. Air cavalry squadrons supported nearly every division in-country. Even though there remained only one truly airmobile division, helicopter mobility flourished. As General Westmoreland noted: "During 1966, airmobile operations came of age. All maneuver battalions became skilled in the use of the helicopter for tactical transportation to achieve surprise and out-maneuver the enemy" (Tolson, 1973).

In something of an ironic twist, the Vietnam conflict not only “proved” the validity of the airmobile concept, but also severely limited the role it would play in the future of the U.S. Army. Instead of Howze’s vision of widespread helicopter mobility becoming the core concept around which the rest of the Army was built, Vietnam effectively confined the air assault concept to two specialized divisions. As company- and regiment-sized operations had been more common, the airmobile concept remained one of supporting existing combat arms rather than replacing them. Furthermore, the unconventional nature of the enemy in Vietnam stigmatized it as being useful primarily for “small wars” instead of large-scale conventional conflict as its visionaries had espoused (Allen, 1993). Had Vietnam turned out differently, the Army might have moved around the future battlefield more by aircraft than by ground vehicles.

16. Helicopters

The evolution of the American helicopter throughout the Vietnam War is closely tied to previously discussed airmobile concept. By the time of U.S. withdrawal, American and South Vietnamese forces had employed over a dozen different models of helicopters, many with several incremental (i.e., the UH-1C, D, H, etc.) variants (Bowman, 1985). However, the airmobile concept came to be embodied by four primary machines in use by the U.S. Army: the UH-1, the AH-1, the Light Observation Helicopter, and the heavy lift CH-47 (Tolson, 1973).

It is beyond the scope of this study to detail the numerous changes made to each of the helicopter types. Instead, it is more useful to look broadly at the Army’s attempt to modify its helicopter force mix in response to the operational environment and expanding mission set. As the CH-47 and UH-1 programs pre-dated Army involvement in Vietnam, the Army’s attempt to fill its requirement for a dedicated armed escort platform is the most instructive of the changes made to its helicopter fleet.

The first American helicopters to operate in Vietnam were Army H-21s, troop carriers that had been in service since 1949 ("H-21/CH-21 Series," 2008). Eighty-two helicopters and approximately 400 crew and support personnel arrived in Saigon on

December 11, 1961, to provide South Vietnamese soldiers with battlefield mobility (Tolson, 1973). The H-21s soon proved highly vulnerable to small arms fire.

As previously discussed, the Howze Board, following its visit to Vietnam in 1962, recommended the deployment of the UH-1 Iroquois (originally conceived as an airborne ambulance) to evaluate its performance as a troop carrier and armed escort. Soon thereafter, the need for defensive firepower drove the modification of the existing UH-1s and the requirement for a gunship variant. As the UH-1, or "Huey" gunships were heavier than their "slick" counterparts, they were also slower, and therefore of limited use in the escort role. In 1964, the Army began its search for a specialized helicopter gunship (Allen, 1993).

Contributing to the Army's difficulty in finding a suitable armed-escort helicopter was the United States Air Force. The USAF had fought the Army's development of the airmobile concept from the time of its inception. Although Secretary of Defense McNamara had sided with the Army on the airmobile concept, a dedicated gunship—one capable of offensive missions—remained a highly contentious issue for the Air Force (Horwood, 2006). Compounding that issue was the fact the Army maintained a small number of heavily armed OV-1 "Mohawk" fixed-wing attack aircraft. These, too, were viewed as infringements upon Air Force roles and missions, and in order to get a new helicopter gunship, the Army had to get the Air Force to stop contesting it. In the end, the Army gave up the OV-1s, along with its light transport fixed-wing aircraft, the C-2, in order to gain the "turf" of the attack helicopter (Allen, 1993; Horwood, 2006).

The AH-1 filled the dedicated gunship role by accident. The Army initially contracted with Lockheed for the AH-56 Cheyenne, known as the Advanced Aerial Fire Support System, but technical difficulties and cost overruns ultimately led to the cancellation of the project. Bell Helicopters had been developing, on its own, a follow-on gunship to the UH-1C. The design included the proven drivetrain of the UH-1 but added a radically altered, purpose-specific airframe. Armament, armor, speed, and combat loiter time were all significantly improved over the existing UH-1C gunships, and with no alternative on the near-term horizon, the Army bought it. After a year of development, the AH-1 was and fielded (Allen, 1993).

17. Airmobile Divisions: First Air Cavalry and 101st Air Cavalry Division

On July 1, 1965 the Office of the Secretary of Defense approved the U.S. Army proposal to convert the 11th Air Assault Division (Test) and elements of the Second Infantry Division into an operational capability—the First Cavalry Division (Airmobile) (Tolson, 1973). During the previous two years, this force had taken the concept of airmobile infantry from the idea phase to an operational capability through rigorous test and evaluation. Nearly three years later, in June 1968, the Army created a second airmobile division by re-designating the 101st Airborne Division as the 101st Air Cavalry Division (Tolson, 1973).

It was no coincidence the decision to create an airmobile cavalry force came at roughly the same time of rapidly expanding involvement in Vietnam. However, the decision to create a unique division centered on the helicopter and the concept of airmobile cavalry was another matter entirely. In order for the Army leadership to buy off on the idea of an entire *division* to be constructed around the relatively new (and perceived fragile) technology of the helicopter, an extensive test and evaluation program would have to be undertaken. The Army would need proof its current methods could be outdone, especially if it was going to mean purchasing hundreds of new helicopters and grant entry into the brotherhood of combat arms to its *aviators*.

The stateside test effort of the 11th Air Assault Division (Test) laid the groundwork. The tenacity of its leadership—primarily General Howze and the commander of the 11th, Brigadier General Harry W. O. Kinnard—were critical to the completion of such a wide-scale effort in just a three-month period (Horwood, 2006). General Kinnard's establishment of an organization that took seriously all suggestions from its members in an effort to harvest the "best practices" from its exercises and tests enabled the airmobile concept to emerge as the superior option to established ground-centric maneuver forces during head-to-head evaluations against elements of the 82nd Airborne Division. The Army leadership's concurrence with General Howze's conclusion that the 11th Air Assault Division (Test) should become immediately operational is a testament to the magnitude of their efforts. However, it is unlikely the Army or the

Secretary of Defense would have agreed to the airmobile division idea outside the context of wide-scale American involvement in Vietnam on the horizon in March 1965.

18. Farm Gate

Much as the Navy and Army had responded to President Kennedy's desire to develop unconventional warfare capabilities for waging counterinsurgecy in Southeast Asia with SEALs and Special Forces, the Air Force stood up a special group of aviators, whose mission was to train and advise indigenous personnel for counterinsurgency operations. General Curtis LeMay ordered the establishment of the 4400 Combat Crew Training Squadron (CCTS), more commonly referred to as "Jungle Jim," shortly before becoming Chief of Staff of the Air Force, in March, 1961. The squadron's initial fleet of aircraft included modified versions of eight T-28 advanced trainers/attack aircraft, 16 C-47 transports, and eight B-26 light bombers (Futrell & Blumenson, 1981) .

It was only after the Joint Chiefs of Staff recommended the covert air interdiction of the Viet Cong's inland supply routes in August 1961 that the mission for "Jungle Jim" became apparent. General LeMay recommended sending a detachment of the 4400 CCTS, which had just been designated operational, to serve under the Military Assistance Advisory Group (MAAG) to devise and evaluate special warfare methods. The Air Force, and indeed the airmen themselves, viewed their mission as an experiement to devise counterinsurgency tactics and methods. President Kennedy, however, approved their deployment—code named Farm Gate—only in the capacity to advise and assist, and "not for combat at the present time" (Futrell & Blumenson, 1981).

19. Herbicidal Warfare

The decision to employ large quantities of defoliant in South Vietnam was not so much a single decision as it was a series of incremental steps, beginning with an idea and ending up with American aircrews spraying large swathes of jungle with a myriad of defoliants. The idea originated—albeit indirectly—with Walt W. Rostow, Deputy Special Assistant to the President for National Security Affairs following a trip to Vietnam in 1961. Upon his return, he recommended the establishment of a unique organization to study solutions to the problems of counterinsurgency, to develop and evaluate

"techniques and gadgets" with which to wage this new kind of war (Buckingham, 1982). The use of defoliants was one of several project ideas generated by the organization, which was eventually formally established as the Combat Development and Test Center.

Much debate occurred about the utility and appearance of herbicide use in Vietnam. The primary objections came from the Secretary of Defense and the Chairman of the JCS, who were concerned about what could be perceived as American use of chemical weapons. Ultimately, President Kennedy agreed to a limited spray program, initially designed to clear foliage from along the sides of key roads and waterways to facilitate ARVN visibility of Viet Cong movements. He and his administration initially disapproved the other component of the defoliation test project: the deliberate targeting of South Vietnamese crops used by the Viet Cong as a food supply (Buckingham, 1982).

In 1964, the test program increased in scope. A pattern developed: limited tests would yield favorable results, which would result in vociferous proponency on the part of South Vietnamese leadership. Inevitably, public revelations of the testing and use of herbicides occurred and brought public scrutiny. The scrutiny, in turn, generated another round of review and evaluation. More significantly, though was the granting of authority for executing both "clearance of key routes" and "food denial" missions to CINCPAC and the American Ambassador. Once that happened, the oversight and scrutiny were significantly reduced, even though "authorization by Washington" was to be obtained prior to engaging in such missions (Bundy, 1961).

The organization primarily responsible for carrying out defoliant spray operations eventually came to be known by its operational code name: Ranch Hand. The initial cadre was formed by Tactical Air Command (TAC) from the handful of personnel attached to the Special Aerial Spray Flight (SASF) based out of Langley, Virginia, whose mission was the application of insecticide to U.S. Government facilities as required. The remainder of the unit was filled out by individuals who had volunteered for the 4400 CCTS but were not selected (Cecil, 1986).

Ranch Hand suffered initially from both the lack of a well-defined mission and being subject to multiple authorities. It remained an ad hoc organization from its

departure from the United States in 1961 until formally adopted as a Detachment 1, 315th Troop Carrier Group, and became an organization permanently assigned to Southeast Asia and reporting to PACAF (Buckingham, 1982).

20. Advanced Tactical Support Base (ATSB)

Following the limited success of the Coastal Surveillance Force (TF 115), the Navy looked for ways to continue improving the effects it was achieving against Viet Cong infiltration via waterway. With the implementation of Operation SEALORDS (TF 194), American and Vietnamese naval forces raided Viet Cong-controlled inland waterways and surrounding shorelines. One significant limitation noted by Admiral Zumwalt, COMNAVFORV, was that several regions of heavy VC activity were far enough away from naval support facilities that the raiding craft had to travel long distances to get there, and spend relatively little time in the area before having to return to base for supplies. Naval presence in these remote regions was sparse enough that they remained firmly in Viet Cong control (Cutler, 1988).

In order to increase his riverine fleet's reach into Viet Cong sanctuaries, Admiral Zumwalt came up with the idea of the ATSB. His initial proposal—to build a riverside base—was deemed "foolishly risky" by Army leadership in the region. He then came up with the idea to build a base in the middle of a river: a floating structure composed of several barges joined together and located within the enemy strongholds. It allowed for patrol craft and raiding forces to stage from and return to a closer base, plus establish a permanent presence in a region previously controlled exclusively by the VC. This idea, too, was deemed "foolishly risky," but he was able to convince General Abrams, COMUSMACV, of the merits of the plan (Cutler, 1988).

The project proved extremely successful in forcing the Viet Cong to relocate. Several ATSBs were built, and each one improved on the concept. One ATSB built on the very southern tip of Vietnam could house 700 sailors and soldiers, and was defended by four 81mm mortars, six .50 cal. machine guns, ten M-60 machine guns, anti-mine nets, and electronic sensors placed on the adjacent river banks to warn of enemy soldiers (Cutler, 1988).

21. Riverine Craft

The U.S. Navy had virtually no riverine craft in its inventory at the start of America's military advisory effort in Vietnam. At the outset of Operation Market Time (TF 115), naval forces were operating "blue water" craft—destroyers, destroyer escorts, and minesweepers—in an effort to prevent infiltration into South Vietnam from the seas. The large size and draught of these craft severely limited the regions near the coast where they could effectively operate. For its part, the Vietnamese Navy possessed smaller riverine craft and conducted patrols inland. However, there were not enough close-in patrols in the shallower waters to affect VC inflitration (Cutler, 1988).

The interim solution was for the Navy to employ 17 existing U.S. Coast Guard cutters, but it also undertook a search for a suitable riverine patrol craft it could procure quickly and cheaply. Fortunately, that search ended quickly when the Navy discovered a commercial solution in use in the Gulf of Mexico: a fifty-foot, all aluminum boat that transported offshore oil drilling crews back and forth to their rigs. It also had a three and one-half foot draught. The manufacturer, Stewart Seacraft, was based out of Louisiana, and despite the Navy's requirement of over 50 modifications to the craft for combat use, delivered them 40 days after they were ordered. The modified version was called the Patrol Craft, Fast (PCF) or, informally, the "swift" boat (Cutler, 1988).

Though quickly procured and highly suitable for the environment, the "swifts" were not without problems. The first variants were prone to corrosion. The deck had no space on which to place the cargo of a suspect vessel that was under search. And the crew living conditions were uncomfortable to the point that patrols had to be limited to 24 hours—any longer required the crew be changed out while afloat (Friedman, 1987). Despite its shortcomings, the "swift" boat carried the brunt of the early riverine work. It was not replaced throughout the conflict, but rather augmented by newer variants.

22. Laser-Guided Bombs (LGBs)

America's quest for a precision-guided air weapon dates back to World War I, but the requisite technology that would make them a reality was not available until the 1960s. Additionally, air-delivered weapons accuracy had improved, but not enough to bring

about a significant improvement in the effectiveness of “precision” aerial bombardment. At the time of America’s initial involvement in Vietnam, several improved weapons programs were in existence, but each had its limitations and flaws that prevented them from making major contributions to the employment of airpower (Gillespie, 2006).

The Navy had developed an air-to-ground missile, called “Bullpup,” that was guided by the pilot after launch using radio signals. Similarly, the Air Force developed the “Walleye,” a glide bomb that used an on-board electro-optical camera system to allow the operator to guide it manually to the target. Finally, the “Shrike” anti-radiation missile had been developed during the 1950s to home in on radar-guided surface-to-air missile systems. However, none of these weapons made a significant difference during the early years of tactical airstrikes and strategic bombardment (Gillespie, 2006).

It was not until the maturation of laser and semiconductor technologies provided the necessary components for the first *suitable* precision-guided weapons (Gillespie, 2006). It is not surprising, however, that technological maturity was not the only force required to enable a change in the way air forces viewed weapons accuracy. During the early 1960s, the U.S. Air Force created a special “limited war” office at Wright-Patterson AFB, Ohio. Its charter was to acquire new technology that promised to provide immediate improvements to air combat in Vietnam.

The former head of the “limited war” office, Colonel Joseph Davis, Jr., had become commander of all armament test activity located at Eglin Air Force Base, in Florida. He had been keenly interested in the problems of precision bombing as applicable to “limited war,” and in his new capacity as test commander, he witnessed a briefing that he thought had potential to make serious improvements in bombing accuracy. He arranged the appropriate audiences for the concept, which had been developed by Texas Instruments. Their idea was a laser-seeking device placed on the nose of an existing bomb, coupled to movable fins for steering. During the first briefing to a joint Air Force and Navy weapons procurement group, the concept was met with laughter; eventually the group would concede the concept was “feasible” (Gillespie, 2006).

Though their idea was technically sound and efficient in that it was constructed around an existing bomb body, little progress was made initially. The idea of semi-active lasers being employed from USAF aircraft did not fit the existing mentality; the relative newness of laser technology did not help matters. Additionally, the Air Force had already committed to the concept of the electro-optically guided "Walleye" air-to-ground missile. Colonel Davis, however, would not let the concept die, at least within the Air Force. He was eventually successful in staging sort of a coup, gathering a group of key general officers for what was ostensibly a weapons program review; in fact it was an impromptu decision briefing, where they were all presented the results of the initial laser-guided bomb trials. At the end of the "review," he presented them with a letter for signature indicating their support for the project. Upon submitting his letter to the Air Force leadership, the laser-guided bomb program began to gain traction (Gillespie, 2006).

The initial combat trials of the laser-guided bomb concept showed marginal results and led to the redesign of several system sub-components. During a subsequent round of combat trials, which took place during July and August 1968, the F-4 squadron carrying out the evaluation experienced significantly improved results: the reduction in CEP (circular error probable, or roughly average miss distance) from 75 feet to just 20 feet. One in four was a direct hit. The system was subsequently declared suitable for employment, but the bombing halt of March 1968 was still in effect. That meant there would be few missions "worthy" of precision-weapon expenditures—those targeting high-value, fixed structures—for the next four years (Gillespie, 2006).

At the same time, a competing program, the AGM-65 "Maverick" air-to-ground missile (the "Walleye" successor) matured, but ultimately cost four-to-five times as much as the laser-guided bomb (by then known by its project name: "Paveway"). Because it was cheaper, "Paveway" was dropped more frequently, and therefore gained a reputation as being highly effective against smaller, mobile targets. By 1972, laser designator technology had matured to the point where it was installed on OV-10 forward air control (FAC) aircraft, carriage pods (for the F-4s), and AC-130 gunships, all of which could provide a terminal guidance point for an F-4 delivered Paveway bomb (Gillespie, 2006).

Consequently, laser-guided weapons were used during Linebacker I and II to limit collateral damage and confine the campaign to military-only targets. For the first time in the history of aerial bombardment, aircraft (those employing “Paveway”) were capable of achieving direct hits with nearly every weapon (Gillespie, 2006). Finally, the potential for collateral damage minimization and sortie reduction were demonstrated in combat and the improvement in results was measurable. A further indicator of the weapon’s success was that shortly after the conclusion of the Linebacker bombing campaigns, it was procured by the U.S. Navy.

23. Aerial Mining

In May 1972, President Nixon finally ordered the emplacement of mines in Haiphong harbor to force the North Vietnamese back to the negotiating table. Mining was accomplished solely by naval aircraft, and effectively prevented Soviet resupply of North Vietnamese war matériel by sea. Senior commanders and civilian leadership had debated about whether or not the mining of Haiphong harbor would ultimately bring about direct confrontation with the Soviet Union as early as 1967 (United States Department of Defense, 1971). The adoption of aerial mining by naval forces was not so much a change made by the service itself, but rather a change to a civilian-directed policy.

24. Fixed-Wing Gunships

In response to difficulty interdicting truck traffic on the Ho Chi Minh trail, the USAF developed a series of fixed-wing aircraft designed to engage targets at the center of a pylon turn. These aircraft were constructed from modified cargo aircraft that already existed in the Air Force’s inventory, starting with the C-47. The side-firing principle, however, required significant effort on the part of several key personnel (Ballard, 1982).

Ultimately, it took several proofs of concept and the deployment to Southeast Asia to provide the overwhelming evidence (in the form of numbers of trucks killed at nighttime) necessary to convince the service to produce them in larger numbers and field them in squadrons. The side-firing fixed-wing gunship quickly proved to be the most efficient truck-killer flying over the Trail. A testament to this fact was the response by North Vietnam to begin moving radar-guided surface-to-air missiles farther south, which

effectively limited the gunship's effective range and provided the Viet Cong with a bit of respite (Ballard, 1982).

25. Suppression of Enemy Air Defense (SEAD) Doctrine

The Korean War saw marginal improvements in the Air Force's capability to counter enemy air defenses. The recorded doctrine of the time, however, does not reflect it. Therefore, air operations begin over North Vietnam with the institutional belief carried over from previous conflicts that altitude alone would be sufficient to prevent engagements due to enemy air defenses. This only held true until the Soviets gave North Vietnamese the high-altitude, radar-guided SA-2 surface-to-air system.

Later in the conflict, as the first American aircraft encountered SAMs and MiGs, political constraints came into being that required defensive-only targeting of SAMs due to the sensitive political nature of Soviet involvement. Consequently, "localized suppression" emerged as the doctrine of choice: "Wild Weasel" and "Iron Hand" missions became the primary means of suppression while strike packages completed missions. Those political restrictions were removed in 1971 and air planners shifted toward "campaign" SEAD, which consisted of the strategic bombing of missile facilities and storage sites to attrite enemy air defenses without having to first be engaged by them (Momyer, Lavalle, & Gaston, 2003).

26. B-52 Conventional (Non-nuclear) Bombing

In April 1964, General Westmoreland pleaded with the JCS to allow the use of B-52s to bomb Viet Cong base camps within the confines of South Vietnam. Prior to the Vietnam Conflict, the B-52's sole mission was to deliver nuclear weapons against strategic targets deep within denied territory. Nevertheless, the JCS conceded to General Westmoreland's wishes and deployed the mainstay of America's strategic nuclear force to Southeast Asia. The subsequent strikes began in June 1965, and were code-named Arc Light. The debate over the proper employment of the B-52 was kept alive by the fact that their initial employment was not even in the strategic bombing role; instead, Arc Light was a ground support campaign conducted mostly over South Vietnam, and designed to interdict enemy infiltration of troops and supplies from the north (Head, 2002).

As American involvement in Vietnam expanded in 1965, the USAF purchased what was known as the “Big Belly” or “High Density” modification to the B-52D model fleet to provide a significantly increased conventional munitions payload capability. The modification effectively increased the B-52’s bomb load capacity from 38,000 pounds to 60,000 pounds. B-52 crews carried out Arc Light strikes until 1973, but it was not until they were incorporated into the Rolling Thunder campaign of 1972 that they performed the strategic bombing mission for which it was designed (Head, 2002).

D. ANALYSIS

As in the earlier analysis of World War II, the effect of each change is categorized as either “major” or “minor.” A change is assessed as having a “major” effect if the results of the implementation of that change: (1) improve the strategic situation, (2) positively reverse the course of a failing operation or campaign, or (3) enable a previously unobtainable objective, strategy, or tactic. Otherwise, the change is assessed as “minor” (see Table 9).

Similarly, the essence of the change is assessed. Changes in the form of modifications to existing equipment, concepts, tactics, etc. are considered “incremental.” Changes that create previously unemployed tactics, implement a wholly new military application for technology, or define a new means by which to wage war are all considered “transformational.” This includes the instances where the U.S. military simply emulated another military. All other changes are labeled “incremental.”

	Nature of Change		
Effect of Change		Incremental	Transformational
	Minor	B-52 Conventional Bombing Search and Destroy Marine ARG/SLF Raids Fixed-Wing Gunships M113 ACAV M16 SEALs	Vertical Envelopment - Airmobile Divisions - Helicopters Farm Gate Herbicidal Warfare TF 115 / 116 / 117 - "Swift" boats - ATSB Brown-Water Naval Doctrine - TF 194
	Major	Aerial Mining (Naval) SEAD Doctrine	Pacification - CIDG - CAPs Laser-Guided Bombs

Table 9. Level of Effects and Nature of Changes

Of the changes made at the strategic level, neither the *product champion* nor *civilian intervention* provides a greater explanatory power. The seven changes are split evenly between the two (see Table 10). The primary reason for a split in the odd number of changes is the existence of both a *product champion* (General Westmoreland) and a willing *civilian intervenor* (President Johnson) in the proposed change from the advisory/counterinsurgency role to large numbers of American troops conducting search-and-destroy missions. The overall assessment is that civilian intervention is the more powerful explanatory hypothesis, largely because even though the military leadership has the power to stall, civilian leadership has the authority to block any military initiative.

	Product Champion	Civilian Intervention
B-52 Conventional Bombing	X	
Search-and-Destroy	X	
"Large Unit" Operations	X	X
SEALs		X
Herbicidal Warfare		X
Aerial Mining		X
Pacification	X	

Table 10. Vietnam War Strategic-Level Changes.

The changes initiated at the operational level—where campaigns and major operations are managed—were more prevalent than in the World War II examples. This may be attributable to the unfortunate position in which more than one American commander found himself—that of ineffectiveness against an elusive enemy and experiencing uncertainty about how to achieve decisive results against him.

Of the operational-level changes examined, seven out of eight are explained by the *planned* hypothesis; that is, the operational commander and his staff first made predictions about what they believed to be necessary capabilities for achieving their objectives (See Table 11). They set about developing those capabilities for operational employment. In essence, the organization worked as it should have. It is also noteworthy that five out of those six *planned* changes originated from within the Navy/Marine Corps team. Of the Navy changes, all were directly attributable to the willingness to expend time and effort to study the problem at the "ground level." The recommendations made by Captain Bucklew were directly translated into the numbered task forces that defined the Navy's "brown water" capability, even though nothing of the sort physically existed before entry into the conflict. Admiral Zumwalt's TF 194 simply built on those concepts, but was grounded by his extensive traveling and visiting the forces under his command.

	Planned	Emergent
Marine ARG/SLF Raids	X	
TF 115	X	
TF 116	X	
TF 117	X	
TF 194	X	
SEAD Doctrine		X
Brown-Water Naval Doctrine	X	
Vertical Envelopment	X	

Table 11. Vietnam War Operational-Level Changes

The lone emergent operational change was SEAD doctrine. The principles by which enemy air defenses were countered were fluid; though there may have been a centralized plan for dealing with North Vietnam's air defense system, it was soon overcome by events. Pre-war doctrine would have had air defense systems targeted pre-emptively, before launching air missions into hostile territory. However, with the introduction of the SA-2 surface-to-air missile system by North Vietnam came limits imposed upon airmen as to where and when they could target SAMs. These limitations were designed to keep the Soviet Union from directly entering the war on the North's behalf. The unintended consequences were that American airmen many times had to wait to be engaged by a SAM for it to be targeted. This fact generated numerous changes to tactics and spawned the requirement for a whole host of electronic combat capabilities that did not exist at the time.Of Of the tactical-level changes, the implementation of the CIDG and CAPs started at the very lowest level of warfare: the individual. In both cases, one individual carried out an idea in a single location and achieved positive results. The resulting success spread largely due to the absence of an alternatives. For the CIDG, the CIA and the SF did not initially command large numbers of troops with which to patrol and provide the population security they believed necessary to keep the VC from

infiltrating the highland villages. For the Marines, the CAP concept sprung from a similar situation. Village security was identified as a key weapon against VC recruitment and infiltration in the South, and the only way a platoon leader was going to be able to guarantee sustained security to the village he was assigned was to move his platoon in full time.

In both cases, the individual units had the authority to exercise the initiative that resulted in success. Therefore, decentralization provides the better explanatory power in Vietnam. It must be noted, though that decentralization was not the sole factor; the unsatisfactory initial results plus an absence of alternatives combined with the freedom to experiment were all present.

	Decentralization	Excessive Casualties or Mission Failure
CIDG	X	
CAPs	X	

Table 12. Vietnam War Tactical-Level Changes

The technological changes examined that occurred during the Vietnam War were overwhelmingly due to a specified combat need. Five out of the seven did not exist prior to the beginning of American involvement but were brought into existence by the interpretation of combat results and the generation of a requirement from the theater of war. One technology—the laser-guided bomb—was in fact desperately needed but not formally requested for two reasons: (1) the technology was largely unheard of, and (2) there existed a substitute (even though the substitutes were inferior, the performance of "Paveway" was not known to be better at the time). In that instance, it was not until a USAF colonel personally undertook the mission of getting the new technology into theater for a combat evaluation that it stood a chance. Positive combat results were the only reason the Paveway system was adopted.

On the surface, it appears reassuring that changes to the technology of a military at war were delivered expeditiously enough to be fielded in time. Part of the reason the *procurement inertia* hypothesis was proposed is because of the time required for a military-industrial complex to produce anything new—that is, not already somewhere in the production process. The fact only one instance of *procurement inertia* was observed in this study might also signal another explanation.

	Combat Need	Procurement Inertia
M113 ACAV	X	
M16		X
"Swift" boat	X	
AH-1	X	
ATSB	X	
Fixed-Wing Gunships	X	
Laser-Guided Bombs[1]		X
[1]Though the need for precision-guided munitions existed, the stated operational requirement did not come from PACAF until the developmental team had pushed a combat test through and demonstrated limited success.		

Table 13. Vietnam War Technological Changes

One might speculate that the conflict's lengthy duration actually accommodated the normal military acquisitions cycle. This is only partly true; a closer look at each instance where a system was procured because of a combat need, the acquisition timeline was accelerated in some manner. For example, the "Swift boat" was purchased as a modified civilian craft, which shaved years off what would have been a lengthy design-and-development timeline. The AH-1 flew combat missions less than 18 months after it was evaluated due to the initiative of the Bell Helicopter company. The M113 ACAV modifications were copied directly from the South Vietnamese, whose bloody experience at Ap Bac provided the knowledge necessary to make positive change.

IV. OPERATIONS ENDURING FREEDOM AND IRAQI FREEDOM

A. INTRODUCTION

This chapter represents an attempt to assess ongoing combat operations in Afghanistan and Iraq. It covers the period of time from the attacks of September 11, 2001 to the present, and describes the conditions and effects of significant changes as best as they can be understood at the end of 2008. The passage of time and the future writing of more definitive history will no doubt provide better insight into the dynamics of the changes presented herein.

B. BACKGROUND

The unique aspect of the American entry into Operation Enduring Freedom—as compared to the earlier cases presented—is the lack of lengthy and deliberate preparatory phase. Less than a month after the attacks on the World Trade Center and the Pentagon, American bombers were eliminating known terrorist training facilities in Afghanistan; special mission units and Special Forces soon followed. The nature of the attack against America demanded a quick, decisive response; those forces capable of responding quickly did so.

These conditions stand in stark contrast to the entry into Operation Iraqi Freedom. During the summer of 2002, speculation about a possible invasion of Iraq created the need for detailed war planning, exercises, and rehearsals—all carried out while operations continued in Afghanistan. Indeed, one central lesson learned in Afghanistan shaped the plan for what would become Operation Iraqi Freedom: the belief in a lighter, faster, networked force supported heavily by airpower as the means by which to achieve a quick, relatively low-casualty victory.

In the wake of conventional operations in 2003, the U.S. found itself still facing an elusive Taliban/Al Qaeda in Afghanistan and an increasingly violent insurgency in Iraq. American commaders—much like in Vietnam—found themselves waging a fundamentally irregular conflict for which they were largely unprepared. Numerous

changes were made in an effort to improve the ability to find, fix, and finish enemy combatants. Few changes had far-reaching effects against either insurgency. A representative sample of them are presented here (See Table 14).

C. SAMPLE CHANGES

<table>
<tr><th></th><th>Land</th><th>Air-Land</th><th>Air</th><th>Air-Space</th></tr>
<tr><td>Organization</td><td>Human Terrain System

Joint IED Defeat Organization (JIEDDO)</td><td colspan="3">Counter-Scud Task Force</td></tr>
<tr><td rowspan="2">Doctrine</td><td rowspan="2">Counterinsurgency Doctrine</td><td>Bomber CAS</td><td>NTISR</td><td></td></tr>
<tr><td colspan="3">Time-Sensitive Targeting</td></tr>
<tr><td>Technology</td><td>Stryker Vehicle

HMMWV Armor Modifications

MRAP</td><td>Man-Portable UAVs</td><td>Advanced Targeting Pods

Small Diameter Bomb (SDB)

Armed UAVs</td><td></td></tr>
<tr><td colspan="5">Changes initiated during Operation Iraqi Freedom are presented in bold.</td></tr>
</table>

Table 14. Selected Changes for OEF and OIF

1. Joint Improvised Explosive Device Defeat Organization (JIEDDO)

The JIEDDO was formally established on February 14, 2006 by DoD Directive 2000.19E, signed by Acting Secretary of Defense Gordon England, with the stated mission to "…focus (lead, advocate, coordinate) all Department of Defense actions in support of Combatant Commanders' and their respective Joint Task Forces' efforts to defeat improvised explosive devices as weapons of strategic influence (JIEDDO annual report, 2008). JIEDDO is the second evolutionary step of what was initially a unilateral Army effort to stem mounting IED-related casualties.

In October 2003, General John Abizaid, Commander of U.S. Central Command, wrote a memo to Secretary Rumsfeld and the Chairman of the Joint Chiefs of Staff,

General Meyers, requesting assistance with what he called the “number one killer” of American troops. In his memo, he proposed an effort similar to the “Manhattan Project” which had pooled leading civilian scientists, industry experts, and military personnel together in a single organization that produced the first atomic weapons during World War II. What resulted was a 12-person task force set up within the Department of the Army, and soon thereafter, bureaucratic stagnation (Atkinson, 2007; R. F. Ellis, Rogers, & Cochran, 2007).

In July 2004, Deputy Secretary of Defense Paul Wolfowitz, frustrated by the lack of progress and steadily increasing IED attacks on American troops, authorized the establishment of an Army-led joint task force, which brought the remaining services into the effort (R. F. Ellis et al., 2007). The following month, the newly redesignated joint integrated process team (JIPT) carried out experiments in Iraq in accordance with General Abizaid’s desire to operationally test any equipment that had “a better than even chance of success” (Atkinson, 2007).

By May 2005, IED attacks on American forces numbered more than 1,000 per month. In June, Assistant Secretary of Defense England elevated the organization’s status once more by moving it out from underneath the Department of the Army making it a “joint” organization: the Joint IED Defeat Task Force (JIEDD-TF). In addition, Secretary Rumsfeld appointed a retired four-star general to lead it. The JIEDD-TF at that point controlled more than $1 Billion in resources dedicated for “training and technology priorities” ("Rumsfeld Appoints Retired Four-Star," 2005).

As the JIEDD-TF and CENTCOM implemented new technologies and tactics to defeat IEDs, insurgent IED cells adapted by switching detonator mechanisms and shifting kill mechanisms to highly-lethal explosively-formed penetrator (EFP) designs—speculated to have been provided by Iranian operatives. With each advance against the IED devices came a counter (Atkinson, 2007). By the time JIEDDO-TF was made a permanent organization and re-designated for the final time as JIEDDO, its scope of operations had expanded to focus not only on technological solutions for defeating IEDs, but also to attack the IED network and provide training to the affected coalition force; its budget swelled to $3.63 Billion. By 2007, JIEDDO was authorized 418 positions,

encompassed several subordinate organizations, was responsible for developing the DoD's long-range counter-IED strategy, and controlled resources in excess of $4.39 Billion (JIEDDO annual report, 2008).

2. HMMWV Armor Modifications

Soon after the declaration of the end of major combat operations, U.S. forces came increasingly under attack by what was perceived at the time to be uncoordinated pockets of regime "dead-enders" (Liu, Barry, & Hirsh, 2004). As most of the armored forces had been redeployed home to reduce the appearance of an American occupation force, those troops who did remain relied heavily on the standard HMMWV ("Humvee") for transportation—many of which had soft-sided canvas doors and tops. In August, 2003, the Army twice upped its stated requirement for armored HMMWVs in Iraq; in October it began the transfer of armored HMMWVs from bases around the world to units operating in Iraq. In November, the Army began attempting to procure more add-on armor kits for its HMMWV in order to fill what was expected to be a shortfall of suitably protected vehicles by tripling the number of suppliers from which it bought the kits (Squitieri, 2005).

The Army realized in June 2003 it did not have enough armored HMMWVs in Iraq to protect troops from the increasing attacks by made by insurgents (Squitieri, 2005). The lack of armor combined with the daily enemy contact drove individual units to improvise their own armor configurations. This resulted in marginal increases in protection, but also to other problems with the HMMWVs, as the extra weight of the armor took its toll on transmissions, engines, and suspensions. Additionally, the improvised armor created a tendency for the vehicles to roll during quick turns (Liu et al., 2004). One Alabama National Guard unit even had local machine shops and volunteers install donated armor plating before deploying to Iraq (Zoroya, 2004). Though armored HMMWVs protected troops from roadside IEDs and side-attacks, insurgent forces soon discovered and exploited the inherent vulnerabilities of its underside.

3. Mine-Resistant Ambush Protected (MRAP) Vehicle

In December 2003, Deputy Secretary of Defense Paul Wolfowitz, concerned with the increasing casualties caused by roadside bombs, directed the JCS to explore options for getting better armor to the troops. The problem was clearly one that demanded urgency. One of the options studied by Joint Staff analysts was a vehicle produced in Namibia called the “Wer’Wolf”—a type of armored, “V”-hulled vehicle known as “mine-resistant ambush-protected” (MRAP) that had been in production for over 20 years (Eisler, Morrison, & Vanden Brook, 2007). However, as the problem was viewed as requiring an immediate solution and the consensus was that the U.S. would not be involved in combat in Iraq for much longer. The chosen solution was to add armor to unarmored HMWWVs and purchase more armored HMWWV variants ("A New Age in Troop Protection," 2007).

Though IED casualties began to increase as the insurgency grew in strength by the end of 2003, the first formal, documented request for 1,169 MRAP was not submitted until February 2005. It was this request that was “shelved” by the Marine Corps, as the Commandant of the Marine Corps, General Michael Hagee determined that the armored HMWWV was the best solution to the need for armor ("A New Age in Troop Protection," 2007).

Though American forces did not employ the MRAP in large numbers, the Marine Corps used it as a means of transportation for explosive ordnance disposal (EOD) teams. It was at a base in Fallujah, Iraq that Marines began to question why the patrols coming under daily IED and ambush attack in Anbar Province couldn’t get such vehicles (Eisler et al., 2007). Mounting casualties only served to increase the perceived disparity. The Marine Corps leadership still believed the modified HMWWV was the best solution and had decided the Marines would hold out for a future program, the Joint Light Tactical Vehicle (JLTV) (Eisler et al., 2007).

While the armored HMMWV solution provided an increased measure of protection, it also drove the insurgents to adapt their tactics. Between January and September, 2005 there had been only 10 attacks in Anbar Province in which an IED was

emplaced on a roadway and detonated as a convoy passed over it. In January 2006, there were 16, and there would be 120 for the entire year ("A New Age in Troop Protection," 2007). The enemy had witnessed the effectiveness of the side armor and discovered the vulnerability of the HMMWV to attack from below.

Though the troops experiencing such attacks were painfully aware of the shift in tactics and the serious problem buried IEDs posed, it is not clear the decision-makers at the Marine Corps, Army, or Joint Staffs understood the ramifications. More importantly, the staff sections assigned to study and make recommendations concerning the Urgent Universal Needs Statement (UUNS) submitted by the Marines in February 2005 questioned its urgency and recommended it be filled by existing and future programs—already budgeted and approved—instead of the unique, commercially available vehicle requested (Gayl, 2008). The request disappeared within the bureaucracy for several months.

Fifteen months later, Marine leadership in Iraq sent a second request, only this time they sent it through the U.S. Central Command chain, which effectively bypassed the Marine Corps headquarters staff and ensured the requirement would be reviewed by the Joint Chiefs of Staff. This action resulted in the Commandant of the Marine Corps receiving a comprehensive briefing concerning the delay of the previous request and a detailed accounting of the IED-related casualties experienced by the Marines in Anbar. The Commandant immediately agreed to support the requirement, as would the Secretary of Defense, the Joint Staff, and eventually the Army (Gayl, 2008). Secretary of Defense Gates made fielding the MRAP his number one priority and publicly declared that delivery speed—not price—was the key criterion (Axe, 2007). MRAPs began showing up in-theater in significant quantities in 2007 ("A New Age in Troop Protection," 2007). By one estimate, the delay in fielding the MRAP cost an extra 762 American lives (Gayl, 2008).

4. Human Terrain System

The deficiencies in American knowledge of local Iraqi culture became a significant disadvantage once the insurgency began to grow in 2003. Following

complaints by officers serving in Iraq, the Department of Defense contacted a Yale-educated cultural anthropologist, Montgomery McFate, who was working for the Navy at the time and had been advocating the use of social science to improve military operations and strategy (Kipp, Grau, Prinslow, & Smith, 2006). Her first project in response to the complaints of lack of local cultural knowledge was to develop a detailed database of information on the local population for use by the officers. The following year, a retired special operations colonel joined the program and advocated embedding social scientists with combat units (Rohde, 2007).

The concept became increasingly important as the U.S. military focused on improving its counterinsurgency efforts. The first Human Terrain Team was fielded in Afghanistan in 2007. The Human Terrain System concept centers around the individual team, which is composed of a civilian social scientist (an anthropologist), a military team chief, an area specialist, and research manager ("Human Terrain Team," 2008). The rest of the "system" consists of a reachback capability to harness a network of subject matter experts from the DoD, interagency, and academia, and is managed through the U.S. Army's Foreign Military Studies Office, a part of Training and Doctrine Command (TRADOC) (Kipp et al., 2006).

Units in Iraq and Afghanistan that have employed the teams have given them high marks for utility; brigade commanders use their inputs in parallel with intelligence to make decisions about how to operate and employ within the neighborhoods in their sector. The only major objections noted in the literature have come from academics, who largely express the belief that the social sciences will be corrupted if wielded under government control (Jayson, 2007). A good measure of how the Army viewed the teams following their initial deployments was its commitment to expand from six teams to 26, and its budgeting of $40 million to fund them for 2008 (Mulrine, 2007).

5. Counter-Scud Task Force

During the preparation for what would become Operation Iraqi Freedom, President Bush emphasized to the CENTCOM commander, General Franks, the importance of keeping Israel out of the war (Woodward, 2002). This meant preventing

the launch of Iraq's surface-to-surface missiles (more commonly referred to as "Scuds," after the SCUD-B variant) at Israeli cities, as Saddam Hussein had done during Operation Desert Storm in 1991. In all, 86 Scud launches took place during that conflict. Of the hundreds of Scud launchers claimed to have been destroyed by aircrews, post-conflict assessment showed the real number destroyed to be precisely zero (Trowbridge, 2003). Therefore, in operational terms, this meant CENTCOM had to organize and field a force capable of "finding, fixing, and finishing" the mobile Scud transporter, erector, launchers (TELs) *before* any could fire their missiles.

The responsibility ultimately fell to the air component, whose commander, Lieutenant General Moseley, who as the Combined Forces Air Component Commander (CFACC) put together a combined team of air- and space-based ISR, strike platforms, and command and control, supported by special operations forces on the ground (Robbins & Leggett, 2003). The task force conducted several live rehearsals (Jumper, 2004), coordinated and executed by members of the Air Combat Command weapons and tactics division. The rehearsals used the Nevada desert to simulate the desolate terrain of western Iraq—assessed to be the only feasible launch location due to the limitations of the Scud missile's range and commensurate with the coalition's experience during Operation Desert Storm.

The primary goal of the rehearsals was to exercise the coordination and approval process that would ultimately enable a strike asset to destroy a Scud TEL within minutes of finding it. Over the course of four iterations, a set of procedures evolved that formed the basis of the counter-Scud effort during the first few weeks of the war. During execution, no Scuds were launched from Western Iraq; missiles were fired from the southern portion of the country, but they were directed towards Kuwait. Once the CFACC determined the Scud threat to have been negated, the counter-Scud task force dissolved. Several of the fighter squadrons redeployed to their respective home countries, while the special operations forces assumed new mission taskings in the post-invasion phase of the conflict.

6. Non-Traditional Intelligence, Surveillance, and Reconnaissance (NTISR)

The lack of fixed targets and pre-planned strikes in Afghanistan created the need for an "on-call" approach to allocating airpower. Tactical air needed to be available around the clock, ready to respond to a team on the ground anywhere inside the country. This also meant that whenever that air capability was not needed, the aircrew orbited without tasking.

The implementation of the targeting pod by numerous fighter and attack aircraft gave the aircrew an effective tool—more so thann the naked eye—with which to search the terrain below. However, this capability was not formally harnessed into the ISR collection management system. That is, until Brigadier General Rew, former director of operations for CENTAF and Ninth Air Force (a former F-16 wing commander), substituted an advanced targeting pod-equipped F-16 for a U-2 on a mission to collect imagery over southern Iraq in 2002. He made the substitution because the F-16 could fly below the weather and was more responsive to re-tasking than the pre-scheduled U-2 mission (Tirpak, 2006).

Non-traditional ISR became a standard mission for targeting pod-equipped jet during Iraqi Freedom. The concept proved useful enough that it was expanded by using microwave transmitters, mounted inside the targeting pods to transmit the imagery the crew saw while airborne to a specially equipped receiver on the ground, called remote off-board video enhanced receiver (ROVER). During CAS, ROVER effectively enabled the supported controller on the ground to view the immediate battlespace from the overhead perspective. It also provided a new means by which to ensure an aircraft releasing weapons was doing so at the correct aim point. While at first there was resistance to becoming "manned Predators," the practice was adopted to the extent the equipment was available largely because the CFACC viewed it as "the right thing to do" (Tirpak, 2006).

7. Time-Sensitive Targeting

The USAF's effort to engage dynamic, mobile targets has its modern origins in the failure to interdict Scud missile launchers during Operation Desert Storm (Fyfe, 2005). Scuds were initially determined to be of little tactical threat; however, the strategic significance of the launches became readily apparent to the coalition when missiles began to rain down on Israeli cities, threatening to expand the war outside the borders of Iraq and Kuwait. Initial attempts to send aircraft to areas of Iraq where Scud launches had been either visually observed or detected by reconnaissance satellites resulted in a time-consuming, centralized effort to reprioritize airborne or ground alert assets, which often arrived at the reported location only to find empty desert.

The experience of Operation Allied Force (OAF) was only marginally better; at the outset, there still existed no formal process by which to prioritize targets and re-task aircraft while airborne. The closest substitute was the development of the concept of "flex targeting," where certain aircraft were designated as capable of switching targets once airborne and others were placed on strip alert in the event of a high-value or emerging target. These initiatives were a step in the right direction, but did not satisfactorily address the issue of targeting priority in real time. Some of the "flex" missions took aircraft away from striking intended targets that were ultimately of higher priority than the targets to which they were "flexed." Following the termination of OAF, Air Force leadership made a concerted effort to develop the doctrine and technical capability to prosecute time sensitive targets smoothly (Fyfe, 2005).

Though numerous advances had been made towards implementing a workable, efficient TST process—largely through improvement of the operations and training of the personnel manning the Air Operations Center (AOC)—most of the guidance and doctrine documents were still in draft form by the time the U.S. entered into combat operations in October 2001. Therefore, CENTCOM and CENTAF had conflicting, redundant TST processes that hampered early efforts to engage emerging targets. Differences in the methodologies by which each staff's targeteers estimated the desired impact points and potential collateral damage created a situation where each staff checked the other's work, thereby lengthening the execution timeline. Furthermore, CENTAF emphasized the time

aspect, and attempted to execute as quickly as possible, whereas CENTCOM emphasized the sensitivity aspect, more heavily weighting potential collateral damage and other factors, which in turn dictated the timeline of a strike (Fyfe, 2005).

Most significant was the centralized authority required to conduct TST strikes early in OEF. The senior levels of CENTAF and CENTCOM were the approval authorities for TST strikes, except for cases of select leadership targets, when the Secretary of Defense himself gave the approval. An Air Combat Command-sponsored analysis of TST conducted during the ongoing campaign noted the previously mentioned difficulties, plus the observation that in many instances, the TST process itself largely depended on the personalities of the individuals interacting between CENTAF and CENTCOM at the time. The study provided four key recommendations for improvement, all of which were aimed at standardizing definitions and processes. After five months of operations in OEF, a truly joint TST process emerged (Fyfe, 2005).

The concepts developed in OEF provided the fundamental platform on which the counter-theater ballistic missile (CTBM) task force would develop their decentralized rules of engagement and procedures for rapidly engaging emerging targets, but without sacrificing collateral damage concerns. In turn, the counter-Scud team put into place the procedures in OIF that—once the Scud missile threat diminished—enabled a truly fine-tuned TST process to be used against non-TBM emerging targets. In fact, the process became so streamlined and effective that virtually any emerging target—not just those of a "time sensitive" nature—was handled by the TST cell (standard CAOC procedures would have normally had the offensive duty staff handle such changes) (Fyfe, 2005).

8. Counterinsurgency Doctrine

Top American leadership had a problem identifying the increasing violence against U.S. troops in the wake of the successful overthrow of the Hussein regime as indications of an insurgency. Secretary of Defense Rumsfeld actually refused to use the word "insurgency," and instead attributed the resistance to regime "deadenders" (Liu et al., 2004). However obstinate national leadership might have been, commanders in the field saw the true nature of the situation: that former Ba'athists and newly unemployed

Iraqi military personnel had banded together to form a loosely orchestrated, primarily local opposition to the occupying American forces. Additionally, foreign fighters came from neighboring countries to aid the effort. By April 2004, senior military officials in Iraq acknowledged they were indeed fighting an insurgency, but were spending enormous efforts to combat the mounting casualties resulting from the ever-increasing IED attacks (Pirnie & O'Connell, 2008).

Though a few individual commanders at the tactical level made adjustments to how they conducted operations, such as Colonel H. R. McMaster's deliberate counterinsurgency operation within the city of Tal Afar in 2005 (Mansoor, 2008), an effective, coordinated strategy did not exist until 2007. Though American casualties steadily increased and public support for the Iraq war waned through 2006, the mid-term congressional elections provided the most urgent impetus for a change in strategy. The day prior to the elections, Secretary of Defense Rumsfeld noted the need for a "…major adjustment…" and that "…what U.S. forces are doing in Iraq is not working well enough or fast enough." The next day, following the Democratic gains in the house and senate, the President accepted Secretary Rumsfeld's resignation (Pirnie & O'Connell, 2008).

In early 2007, President Bush had three separate, recently completed studies from which he could choose a new course of action. General Pace, Chairman of the Joint Chiefs of Staff had initiated an internal review at the end of 2006 that assessed strategic options. Similarly, the president had previously ordered his National Security Advisor, Stephen Hadley, to conduct a similar internal review. Finally, the Iraq Study Group's assessment of the declining situation in Iraq had recently been completed. In the end, he opted to undertake what was quickly but confusingly referred to as the "surge" (even though it involved much more than the simple increase in numbers) strategy of increasing troop levels by 30,000 (Pirnie & O'Connell, 2008).

During 2006, the individual who would be selected to implement the "surge" forces—Lieutenant General David Petraeus—had overseen the authoring of the Army's and Marines' first counterinsurgency doctrinal publication in the last 20 years (Milburn, 2007). During his confirmation testimony as the newly appointed commander of Multi-National Force-Iraq, General Petraeus outlined how he would employ the additional

troops, discussing the "…primacy of population security…" and the "…need to achieve sufficient security to provide the space and time for the Iraqi government…to move forward." More importantly, he stated that simply having more troops in the country would not be nearly as important as "…what they will do and how they will do it..." (Transcript, 2007).

Once in command, General Petraeus set about implementing the principles about which he testified. His strategy was a combination of refocusing operations on achieving population security by establishing a more permanent presence "outside the wire," and increasing efforts to get local populations to increasingly take responsibility for their own security. This meant extending contracts to tribes that would volunteer to fight al-Qaeda in Iraq (AQI) as well as overseeing further increases in the Iraqi military (Mansoor, 2008). Though claims of success are premature, sectarian violence and attacks on coalition soldiers plummeted as a result. Judgment about future outcomes aside, Multinational Force, Iraq (MNF-I) fully implemented a unified counterinsurgency doctrine.

9. Bomber CAS

The first use of a B-52 in the close air support (CAS) role took place during the Vietnam War. The U.S. Marines had worked out the procedures and equipment necessary to make effective use of the bomber's persistence and heavy ordnance load in close proximity to friendly forces by employing a mobile ground-based radar-direction system call Combat Skyspot. Most notably, B-52 crews flew 2,500 sorties in support of the besieged marines at Khe Sanh (Theisen, 2003). Despite that experience and the subsequent execution of CAS missions during Operation Desert Storm, the USAF bomber community did not routinely train for or emphasize CAS, except for a "few hours" of academics during mission qualification training (Theisen, 2003).

The B-52, B-1, and B-2 crews preparing for war in Afghanistan following the September 11 attacks planned to conduct strike missions against fixed Taliban and Al Qaeda assets: training camps, radar sites, air defense positions, aircraft, and command posts. These attacks on Taliban infrastructure started on October 7, 2001 and lasted for

approximately three weeks, even though the number of new targets had dwindled and most of the missions were “re-strikes” by the end of those first few weeks. There simply weren’t that many fixed, strategic targets available, and CENTCOM’s rules governing battle damage assessment (BDA) required satellite imagery verification of target destruction. Absence of such BDA—as was the case when poor weather obscured satellite visibility—meant the target went back on the prioritized strike list. Fixed targeting persisted in this manner, even though the CFACC, Lieutenant General Wald would later recount that he believed the air campaign had reached its objectives “…within the first fifteen minutes or so” (Lambeth, 2005).

After 11 days of aerial attack against fixed targets, the DoD announced the official shift from fixed targets to targets of opportunity. By October 16, Northern Alliance leadership was requesting Americans shift their aerial targeting to Taliban front line troops, instead of re-striking airfields. However, by the end of October, B-52 crews were dropping bombs on the front line Taliban troops at the direction of small teams of special operations forces and their Northern Alliance counterparts (Theisen, 2003). While the bombers’ effects were deadly, the initial coordination between ground controller and bomber crew—who had no visual means by which to positively verify friendly or target position—was sometimes problematic. Even among aircrews who trained routinely with CAS coordination procedures, errors were made, such as the F/A-18 that dropped a Joint Direct Attack Munition (JDAM—a GPS-aided 2,000 pound bomb) too close to a friendly position during the battle at Qala-i-Jangi prison (Lambeth, 2005).

It was the combination of few remaining fixed targets and the existence of the GPS-guided JDAM that enabled B-1 and B-52 crews to support the ground campaign so effectively in the early phases of OEF. Bombers had the persistence to loiter for hours awaiting targets, while the JDAM did not require favorable weather conditions on the ground as other precision weapons did, but was still precise enough to inspire confidence among those on the ground relying on its effects to influence the enemy. Whereas in the aftermath of Vietnam and Desert Storm, the CAS mission was largely forgotten by the bomber community, the experience of OEF appears different. During an initial “lessons

learned" conference in 2002, the ad-hoc nature of the bomber/terminal controller coordination was addressed, and the outcome was a recommendation for the bomber community to fully adopt the joint CAS doctrine and modify its tactical employment manuals to incorporate CAS procedures. Another recommendation was for minor changes to be made to the joint CAS procedures and publication to better accommodate the employment of bombers and their coordinate-seeking weapons (Theisen, 2003).

10. Small Diameter Bomb (SDB)

The USAF declared its GBU-39, better known as the "small-diameter bomb" (SDB) initially operational capable (IOC) in October 2006 (Wicke, 2006). The new 250-pound bomb was designed to provide a precise, lower-yield effect than existing 500- and 2,000-lb. variants. While this weapon will prove useful in support of urban combat operations in Iraq, its existence stems from a concept generated in 1998, well before the U.S. was engaged in Operation Enduring Freedom. The SDB will eventually be employed from numerous USAF aircraft, but the only one capable at the time of this writing is the F-15E (Wicke, 2006).

11. Armed UAVs

The USAF and CIA had jointly used the Predator unmanned air vehicle (UAV) to monitor the conflict in the Balkans, dating back as far at 1995 (Cooter, 2007). The program remained limited, employing small numbers of aircraft to track forces and military equipment. It was not until Operation Allied Force in 1999 that the utility of the Predator for identifying real-time targets for strikes by fighter aircraft followed by immediate BDA—all fed directly to the Air Operations Center—become apparent. While the Predator proved useful during Allied Force, the USAFE commander, Lieutenant General John Jumper, viewed some of the missions as missed opportunities, as the Predator was able to identify Serbian vehicles and military forces, but was unable to engage them (Kean & Hamilton, 2004). Additionally, the coordination process to hand off the Predator's target to an attack aircraft proved difficult to execute due to the limitations of the systems in place at the time.

Because of his frustrations during Allied Force, General Jumper insisted the USAF develop the capability to employ weapons from the Predator, and in his next capacity as the commander of Air Combat Command, he personally oversaw the program to do so (Kean & Hamilton, 2004). However, the service's prevailing view at the time was that arming a reconnaissance drone capable of the flight performance of the Predator could be in violation of the Intermediate-Range Nuclear Forces (INF) Treaty. The Department of Defense and the U.S. Air Force had to first satisfy their own legal staffs that they were indeed in compliance with INF before employing an armed Predator.

The details surrounding just which organization—the USAF or the CIA—funded the arming of the Predator conflict in the source literature (Kean & Hamilton, 2004). What is well reported is that testing of the armed version began in the summer of 2001, while unarmed Predators were tracking Bin Laden and al-Qaeda operatives under the direction of the CIA. Further debate occurred between the Director of the CIA, George Tenet, and his own staff about whether or not the Agency had the legal authority to "pull the trigger" on Bin Laden using a piece of military hardware like the Predator. As the debates and funding discussions persisted, the trial Predator deployment to Afghanistan ended. The September 11 attacks effectively negated the remaining debate, as both armed and unarmed Predators returned to the skies over Afghanistan.

Eventually, the USAF pursued arming all of its Predators. Additionally, the severe limitations of the Predator's weapons payload (two Hellfire missiles) prompted the initiation of a larger airframe variant, capable of carrying more weapons. This concept was pursued by the USAF in 2001 and later became the MQ-9 "Reaper," which was declared IOC in October 2007 ("USAF Factsheets: MQ-9," 2008). As of this writing, Reaper is fully employed in Afghanistan, and the U.S. Army has fielded its own armed UAV variant, the MQ-1C "Sky Warrior" (Tirpak, 2007).

12. Advanced Targeting Pods

For years, the Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) pod was the state of the art. Since it entered service in 1987, LANTIRN provided the F-16 and F-15E crews with the ability to precisely navigate and target at low

altitude and at nighttime, providing a significant advantage during ground-attack and pre-planned bombing missions ("USAF Factsheet: LANTIRN," 2007). The next generation targeting pod was built for the Israeli Air Force by the Rafael Corporation, and was called the LITENING I. LITENING I offered improved infrared camera resolution, and Northrop Grumman partnered with them to produce the LITENING II, which was fielded on American fighter aircraft in 1999 ("USAF Factsheet: LITENING AT," 2007).

Improvements were made to LITENING II, to include a daylight-capable TV camera, a laser marker, and improved night imaging using mid-wave infrared sensors. Several improved variants were fielded and remain in service on the USAF's A-10, B-52, F-15E, and F-16, as well as the several other services and coalition partner aircraft (USAF Factsheet: LITENING AT, 2007). During Operation Enduring Freedom, targeting pod-equipped fighters proved extremely capable of identifying both friendly and enemy positions at night.

Advanced targeting pods also provided a night-vision goggle compatible laser marker, which allowed aircrew and ground controllers to "point" out targets and references to one another, thereby minimizing communications and confusion. Initially, only the F-15E and the F-16 employed the advanced targeting pod (Lambeth, 2005). After it proved extremely useful in both the strike and reconnaissance capacities, pods began steadily showing up on an increasing number of coalition aircraft, to include the B-52 and B-1, the latter of which completed its first combat weapons drop using the SNIPER XR advanced targeting pod in August, 2008. Perhaps the most beneficial aspect of equipping strike assets with advanced targeting pods is the ability to transmit the streaming video the crew is seeing in the cockpit to the terminal controller on the ground, who is ultimately responsible for ensuring the aircraft is attacking the correct target.

13. Man-Portable UAVs

There are dozens of models of man-portable UAVs in use in Iraq and Afghanistan. DARPA originally sponsored early projects in the mid-1990s, and the U.S. Army purchased a handful in 1999. Since then, the concept has grown to the extent that nearly every service has its own variants, which are managed by their respective service's

"battlelab" organization. The ease with these systems are procured combined with the limited over-the-horizon capability guarantee they will continue to be employed by American, coalition, and perhaps enemy forces.

D. ANALYSIS

As in the previous analyses, the effect of each change is categorized as either "major" or "minor." A change is assessed as having a "major" effect if the results of the implementation of that change: (1) improve the strategic situation, (2) positively reverse the course of a failing operation or campaign, or (3) enable a previously unobtainable objective, strategy, or tactic. Otherwise, the change is assessed as "minor" (See Table 15).

Changes in the form of modifications to existing equipment, concepts, tactics, etc., are considered "incremental." Changes that create previously unemployed tactics, implement a wholly new military application for technology, or define a new means by which to wage war are all considered "transformational." This includes the instances where the U.S. military emulated another military. All others are labeled "incremental."

	Nature of Change		
Effect of Change[1]		Incremental	Transformational
	Minor	Bomber CAS NTISR HMMWV Armor Modifications Stryker Advanced Targeting Pods Small Diameter Bomb Armed UAVs	Human Terrain System Man-portable UAVs
	Major	Counter-Scud Task Force MRAP	Joint IED Defeat Organization Counterinsurgency Doctrine

[1]Observed effectiveness to date, not predicted effectiveness relative to outcome

Table 15. Level of Effects and Nature of Changes

Of the changes made at the strategic level, civilian intervention provides a greater explanatory power. In the case of the JIEDDO, commanders in the combat theater requested assistance, but the first iteration of the organization floundered a bit under the Department of the Army, as it did not have the authority to direct other services' participation. It was not until the JIEDDO reported to the Deputy Secretary of Defense and had a substantial budget that it was able to make significant headway in the effort to counter the IED threat.

In the instance of the Human Terrain System, there is evidence that the decision to field a "trial team" for the concept was actually the product of a successful civilian-military cooperation, when the combined arms center at Ft. Leavenworth proposed implementing the ideas put forth by Dr. McFate. While a civilian did articulate the concept, there is no evidence that the civilian leadership of the military had to force the the army to adopt the concept. The idea of a small beginning, such as the deployment of a single pilot team, appears to have been met without much resistance—particularly as the need was easily articulated and the cost of such a venture was relatively low.

While these two change samples effectively point to equal explanatory power for *product champion* and *civilian intervention*, the samples also indicate that an idea initially proposed on a small scale (i.e., small team with little to no budget) may be less likely to encounter resistance from service competitors and therefore be more likely to succeed, but only if the demonstration can be shown as unambiguously successful.

	Product Champion	Civilian Intervention
Joint IED Defeat Organization		X
Human Terrain System	X	

Table 16. OEF/OIF Strategic-Level Changes.

The changes initiated at the operational level—where campaigns and major operations are managed—primarily followed the *planned* model. In each case, an individual or group was assigned to a unique problem set and worked out a concept for a

solution before implementation. In the case of TST doctrine, individuals working within the concerned organizations evolved their warfighting organization and procedures over time, and after examining operational failures. Thus, the TST capability as a tool of the combatant commander was in effect a planned process; the final form, where it became an *effective* tool—one capable of thwarting Scud launches and delivering ordnance on coordinates within minutes of retasking—evolved after much trial, error, and adjustment.

The explanatory power of the *planned* hypothesis must be tempered, however, by the fact that in each of these instances, ample existing data was available regarding past approaches to the problems. In the case of the counter-Scud task force and TST operations, planners had the experiences of Operations Desert Storm and Allied Force to examine for applicable lessons, of which there were many. In the case of counterinsurgency doctrine, there existed the widely documented difficulties of the Army and Marines from 2003-7, as well as numerous written accounts of historical insurgencies. This is not to take anything away from the successful change agents involved in these samples, but rather to highlight the practice of relevant history being analyzed and its lessons applied to future military operations—with great effect.

	Planned	Emergent
Counter-Scud Task Force	X	
Counterinsurgency Doctrine	X	
TST	X	X

Table 17. OEF/OIF Operational-Level Changes

Of the tactical-level changes, both bomber CAS tactics and non-traditional ISR resulted from individual tactical units responding to the conditions of the conflict at the time. The strategic bombers effectively ran out of fixed targets at about the time small numbers of special operations forces were introduced into Afghanistan. The NTISR mission was a direct result of targeting pod-equipped tactical aircraft “on call” following the end of major combat operations. Though there was some initial resistance to being

officially tasked to do reconnaissance, in the absence of being able to expend ordnance, there was little else of value to contribute while waiting for tasking.

	Decentralization	High Casualties or Mission Failure
Bomber CAS	X	
NTISR	X	

Table 18. OEF/OIF Tactical-Level Changes

The technological changes examined that occurred during OEF and OIF reflect two persistent themes: force protection and finding/killing the enemy from the air. Of the seven technological changes (See Table 19), three were found to have been initiated before the attacks of September 11, and were therefore considered products of the existing procurement system at the time. Depending on when the first armed Predator drone was actually employed with the intent to engage targets (the unclassified literature maintains it wasn't until after September 11, 2001), one could point to the fact that the concept of the armed UAV was undergoing test development in 2000, and therefore represents some form of the existing procurement system. It also makes sense to classify it as a response to a combat need because the concept met with such initial resistance from the Department of Defense that it might never have been employed in its armed capacity outside of war.

The paths by which the other four *combat needs* came into service suggest there are two distinct methods by which to force technological changes during wartime: *"do-it-yourself,"* or to *create outside pressure at the top of the organization*. In the instance of the HMMWV armor modifications, individual units simply responded very appropriately and quickly to the tangible need for better protection while patrolling the streets of Iraq. As casualties increased, so did public outcry. Stories of homemade HMMWV armor kits and individually purchased body armor prompted congressional hearings at which DoD leadership was called to account for its failure to adequately protect its troops. It was this congressional pressure that snapped DoD leadership out of the inaction created by belief

the U.S. wouldn't be in Iraq much longer—an example of the "unfreezing" stage Lewin (1948) describes. Effectively, what started out as the do-it-yourself approach ended up creating the pressure for change at the top—the appropriate level where the resources required to fix the situation resided.

The route by which the U.S. military purchased the MRAP follows almost exactly the same pattern. On the other hand, the procurement of small UAVs went largely unregulated until they became so widely proliferated that concerns about deconfliction with airbase traffic and helicopter flight routes prompted a measure of scrutiny. Even now, the services are still trying to figure out which organization, if any, should be responsible for standardizing these systems across the services and integrating them into joint doctrine. These instances of change indicate perhaps the two alternating hypotheses proposed earlier may only partially explain technological change; it appears the existence of *product champions* and *decentralization*—much like strategic- and tactical-level changes—may also play a consistent role.

	Combat Need	Procurement Inertia
Stryker		X
HMMWV Armor Mods	X	
MRAP	X	
Small UAVs	X	
Advanced Targeting Pods		X
Small Diameter Bomb		X
Armed UAVs	X	X

Table 19. OEF/OIF Technological Changes

V. CONCLUSIONS

A. THE EXPLANATORY POWERS OF THE HYPOTHESES

The results of each preceding case are combined here to present a longitudinal view of change at each level of warfare. Because many of these changes are similar and related to one another, they do not represent truly independent observations. It would be misleading to present a quantitative analysis. Therefore, the results from each case are combined in order to make general, qualitative assessments regarding the hypothesis for change across the conflicts as well as the variations between them. In addition, following the assessment of the relative explanatory power of each hypothesis, several observations regarding specific changes are presented to help clarify those overall assessments.

1. Strategic-Level Change

Analysis of he strategic-level changes presented in this study support the hypothesis that the *product champion* wields greater influence at the strategic level of war. But they also indicate that *civilian intervention* has played an increasingly important role in more recent conflicts (See Table 20). Perhaps what is most striking about this data set is the imbalance between significant strategic-level changes made during each of the three conflicts.

World War II and Vietnam exhibited numerous instances of change, though many of them were the creation of new organizations in response to unique challenges that could not be met by the existing force. Vietnam exhibits the greatest number of doctrinal changes. Most significantly, OEF/OIF exhibit two changes: the creation of unique task-organizations in response to specific battlefield deficiencies. Recently, it has proven difficult to make strategic-level changes.

What this ultimately suggests is the ability to make strategic-level change may require not one but both components: a military product champion enabled by agreeable civilian leadership. Civilian leadership always possesses the power to veto or alter a change proposed by the military. The instances of change observed in this study may be

better explained by either the existence of the previously mentioned *civilian intervention* or the *combination* of a product champion and an agreeable (or at least non-hostile) civilian leadership.

Strategic-Level Changes		Product Champion	Civilian Intervention
World War II	Daylight Precision Bombing	X	
	OSS	X	X
	Marine Raiders	X	X
	Long-Range Escort Fighters		X
	OSRD	X	
	Mounted Cavalry		
	Airborne Divisions	X	
	Air Commandos	X	
Vietnam	B-52 Conventional Bombing	X	
	Search-and-Destroy	X	
	SEALs		X
	Herbicidal Warfare		X
	Aerial Mining		X
	Pacification	X	
	"Large Unit" Operations	X	X
OEF / OIF	Joint IED Defeat Organization		X
	Human Terrain System	X	

Table 20. Summary of Strategic-Level Changes

2. Operational-Level Change

The selected instances of operational-level change indicate the *planned* change hypothesis holds the greater explanatory power. However, a shift from *emergent* is apparent between the data for World War II and Vietnam (See Table 21). Upon closer

look, one notices that nearly half of the numerous *planned* changes identified during Vietnam were organizational—and closely related at that. The riverine, coastal, and amphibious task forces all had their origins within the Bucklew Report, the Navy's study initiated to determine how best it could contribute to the counterinsurgency effort.

More telling are the changes in doctrine. During World War II, all of the operational-level doctrinal changes *emerged*; they came into being through the iterative, purposive actions of fielded units that, in most instances, exhibited single-loop learning (error corrective) behaviors. In practical terms, they tried, examined, corrected, and tried again. The results of numerous iterations became the official, recorded doctrine of the services at the end of the war. However, during Vietnam only one doctrinal change can be condsidered *emergent*—SEAD. SEAD doctrine is unique because it was highly dependent on the political constraints put on the series of bombing campaigns. SEAD emerged as a battle of reactive aircraft using missiles and electrons because pre-emptive targeting of Soviet-supplied surface-to-air missile sites was prohibited, largely to ensure the Soviet Union was kept from directly entering the war.

The remainder were undertaken as intentional, planned efforts. The marine raiding concept remained unchanged from its inception, but was abandoned when empty beach after empty beach was raided in search of the elusive enemy rallying points, as the enemy had responded by shifting operations further inland. The Navy's brown-water doctrine was well-conceived from early on in the conflict, and though it changed with the addition of new technological capabilities and innovative concepts for projecting force farther into the inland waterways (such as the Advanced Tactical Support Base), little change was required to the fundamental principles.

Vertical envelopment persisted in a similar manner, not for the soundness of its concept but for the perceived lack of a viable alternative. The army had "proven" the airmobile concept to itself through the test and evaluation of the 11th Air Assault Division (Test) prior to the war. Although changes did occur to helicopter operations, they took the incremental form of improving firepower and coordination. The airmobile concept remained fundamentally unchanged from the initial lift of South Vietnamese troops in December 1962, until the large-scale withdrawal of American combat troops.

The doctrinal changes selected from OEF and OIF are both of the *planned* variety. TST doctrine was developed deliberately following Operation Allied Force, and it was specifically planned for at the outset of OEF. It just was not nearly as effective as it could have been, and therefore ended up exhibiting emergent characteristics as well. The reader might recall that there was no formal joint definition of what exactly a "time-sensitive" target was much less inter-service agreement about just how to go about killing one quickly. Opportunities for improvement were identified and subsequently implemented. The other example, the counterinsurgency doctrine implemented by General Petraeus in 2007, was also a carefully studied and planned event.

Operational-Level Changes		Planned	Emergent
World War II	Amphibious Operations Doctrine		X
	ASW Doctrine		X
	ASWORG	X	
	Carrier Doctrine		X
	Combined Arms Doctrine		X
Vietnam	Marine ARG/SLF Raiding	X	
	TF 115	X	
	TF 116	X	
	TF 117	X	
	TF 194	X	
	SEAD Doctrine		X
	Brown-Water Naval Doctrine	X	
	Vertical Envelopment	X	
OEF / OIF	Counter-Scud Task Force	X	
	Counterinsurgency Doctrine	X	
	TST	X	X

Table 21. Summary of Operational-Level Changes

Therein lays a dichotomy regarding operational-level change. On the surface, emergent change appears to be the overwhelming way of earlier American conflict, characterized by the trial-and-error iterations of World War II. However, the more recent preponderance of planned changes persisting through to the end of a conflict does not indicate whether it is a positive development; it only demonstrates that changes—particularly doctrinal—are less likely to occur once the U.S. is at war. Success is therefore highly dependent on the assumptions about and understanding of the enemy at the outset of hostilities.

3. Tactical-Level Change

Changes made at the tactical level of war are overwhelmingly characterized by the decentralized nature of the command relationships in place. However, decentralization alone is not sufficient to bring about needed changes. During World War II, the two tactical-level changes analyzed were implemented under a decentralized command—individual units were either free to make changes on their own, or far enough removed from higher headquarters that they made changes that otherwise might not be approved (as was the case of General LeMay unilaterally deciding to firebomb Japanese cities). However, another factor acted as a catalyst for change. During both the hedgerow campaign and the bombing effort against the Japanese mainland, units had to first experience mission failure before implementing change.

During Vietnam, the catalyst present, alongside the implementation of the Civilian Irregular Defense Group and the Combined Action Platoons, was the simple lack of resources with which to carry out the assigned missions. The units implementing these changes were quite simply forced into developing creative solutions to tactical problems. In OEF and OIF, both the bomber force's change to the CAS role and the implementation of the NTISR mission by fighter aircraft were attributable to the exhaustion of fixed, pre-planned targets and weapons-employment missions in general.

It is noteworthy that in each instance of tactical-level change analyzed as part of this study, the impacts of the changes on the overall war effort were largely positive. Equally noteworthy is the fact that those tactical-level changes studied for both Vietnam

and OEF/OIF were viewed as ancillary (at least initially). During Vietnam, they were considered a waste of combat power. During OEF/OIF, they were something else to do for the war effort once the "real" mission was over. The tactical-level changes assessed here suggest the American approach to warfare largely produces positive effects, but requires a catalyst in addition to a decentralized command structure.

Tactical-Level Changes		Decentralization	Casualties / Failure
World War II	Hedgerow Combat Modifications	X	X
	Airborne Doctrine		
	Nighttime, Low-Level Incendiary Bombing	X	X
Vietnam	CIDG	X	
	CAPs	X	
OEF / OIF	Bomber CAS	X	
	NTISR	X	

Table 22. Summary of Tactical-Level Changes

4. Technological Change

Technological changes made during World War II indicate internal processes that were highly responsive to the needs of frontline combat troops. Each and every technological change had as its origin a specific *combat need*. However, *procurement inertia* did exist. In the three instances where it was present, pre-existing systems fit the requirements of combat. In fact, the establishment of organizations dedicated to harnessing and implementing cutting-edge technology at an accelerated pace, such as the OSRD and ASWORG, generally guaranteed it.

The same cannot be said of the technological changes made during Vietnam. Of particular note is the quite unintentional adoption of the M16 rifle by the Army. To further complicate matters, procurement inertia does not always result in ill-suited

equipment being forced upon reluctant troops. The example of the first laser-guided bombs is evidence that industry and those who are far removed from the battlefield can conceive of useful technology—it will just be exceedingly difficult to field it if a competing system exists, even if that system is less effective and more costly.

Technological Changes		Combat Need	Procurement Inertia
World War II	SONAR	X	X
	HF/DF Systems	X	
	S-band RADAR	X	
	Norden Bombsight	X	X
	Parachute / Glider	X	X
	Unmanned Bombers	X	
	Bazooka	X	
	Specialized Landing Craft	X	
Vietnam	M113 ACAV	X	
	M16		X
	“Swift” boat	X	
	AH-1	X	
	ATSB	X	
	Fixed-Wing Gunships	X	
	Laser-Guided Bombs		X
OEF / OIF	Stryker		X
	HMMWV Armor Mods	X	
	MRAP	X	
	Man-Portable UAVs	X	
	Advanced Targeting Pods		X
	Small Diameter Bomb		X
	Armed UAVs	X	X

Table 23. Summary of Technological Changes

Furthermore, the technological changes introduced during OEF/OIF split fairly evenly between *combat need* and *procurement inertia*. Moreover, with history continuing to be written on a daily basis, it is too early to make definitive statements about the nature of technological change during these conflicts. However, the initial data indicates that newly developed weapons systems will be fielded to "fit" the needs of the conflict.

B. GENERAL OBSERVATIONS ABOUT WARTIME CHANGE

During the course of this study, several consistencies, or "themes" repeated throughout the individual instances of change. They are presented here not as definitive statements, but rather as suggestions for thinking about how future military change—be it strategic, operational, tactical, or technological—might be enabled, accelerated, or derailed.

1. Artificiality of the Hypothetical Distinctions

Even though the initial hypotheses proposed at the beginning of this study were set up as an "either / or" condition, many changes exhibited both aspects. Furthermore, the distinction between levels of warfare was (as previously admitted) an artificial construct designed to isolate the underlying conditions that influenced the decisions made regarding each change. Just as artificial is the division of the hypotheses by level; for example, there can be and indeed have been numerous examples of civilian intervention at the lower levels (operational and tactical) of war and in forcing technological change. During Vietnam, President Johnson interjected his views into nearly every aspect of the conflict—often resulting in detrimental impacts to military operations.

2. The Power of Product Champions and Civilian Intervention

Likewise, a product champion can exist at any level, and often does. A sometimes decisive factor in whether or not the product champion will succeed or fail is whether or not he can convince the strategic-level decision makers, both civilian and military leadership alike, of the merits of his concept. This is particularly true concerning technological systems that conflict with a service's established order. For example, the procurement of the MRAP required military members to circumvent chains of command

and in a few instances, to request direct congressional intervention. This pattern also existed during World War II, when OSRD Director Vannevar Bush had to end-run the Chief of Naval Operations in order to get his much-needed improvements implemented. It even showed up again during Vietnam, as General Westmoreland privately lobbied an eager President Johnson to send large numbers of conventional combat troops.

3. Demonstration in Combat

One reliable means by which to force military change exists with convincing the civilian leadership of the merits of an idea or concept, and thereby instigating civilian-directed change. One way to accomplish this is through the demonstration of the system or concept in combat conditions. During World War II, a fully mobilized military industrial complex was harnessed effectively by the nation's leading scientists in the form of the OSRD. They studied problems at the ground level, and then proposed solutions that were assessed in the combat theater. During Vietnam, even though the USAF wanted nothing to do with a laser-guided bomb, one *product champion* was able to successfully keep the program on life support long enough to get it fielded with an F-4 squadron flying combat mission in Southeast Asia. Only after the tangible results (not to mention the rave reviews of the pilots and ground controllers) in the form of BDA existed did the service see the merits of that system.

It is worth noting here that the effect of a combat demonstration appears to be so powerful that even a failed demonstration can provide serve to perpetuate an idea long past its prime. An example of this is the unmanned bomber concept, which was introduced into the combat theater without achieving a single positive result. The program persisted through over a dozen mission failures and the deaths of several crewmembers, largely due to its perceived *potential* merit in the minds of those who authorized it.

Finally, the relevance of the demonstration principle is not limited to technical or weapons systems. During Vietnam, both the CAP and the CIDG concepts began with small-scale proofs-of-concept trials, and eventually spread outward. However, the difference in these two changes was the fact that neither COMUSMACV nor the military leadership in the Pentagon was ever convinced of the successes achieved by CAPs and CIDG.

4. Summary

This study proposed that significant changes made by the U.S. military during wartime should be assessed in the context of the appropriate level of warfare at which the change was initiated. Additionally, it treated change as not simply a difference between two static states, but rather as a process. In understanding the process by which change occurred, the driving factors and underlying conditions could be identified. This method of analysis proved effective in deriving several general insights into wartime change and the U.S. military.

First, at the strategic level, a military *product champion* is more likely to bring about change than *civilian intervention*. However, if one looks only at the two more recent conflicts, it is apparent that both *product champions* and *civilian interventions* have become equally important factors. At the operational level, *planned* changes have recently become much more prevalent. This development indicates a more methodical approach to addressing the need for change has developed.

At the tactical level, *decentralized* command relationships result in change—as one would logically expect. However, equally important is another factor—different in each instance—that acted as a "catalyst" to enable the change to occur. The catalysts present in the samples examined in this study were: previous mission failures, lack of resources, and absence of "traditional" mission necessity. It is noteworthy that in all six instances where decentralization enabled change, the resulting change effectively achieved what the initiators set out to accomplish.

Finally, technological changes are largely made in response to *combat needs*. *Procurement inertia* can and does still cause pre-existing weapons systems to be applied to combat needs, but the data shows that during more recent conflicts, if the pre-existing weapon system experiences problems, it will generally be modified or replaced—such has not always been the case in the past. Hopefully, this new-found responsiveness to emerging problems will persist in the future.

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